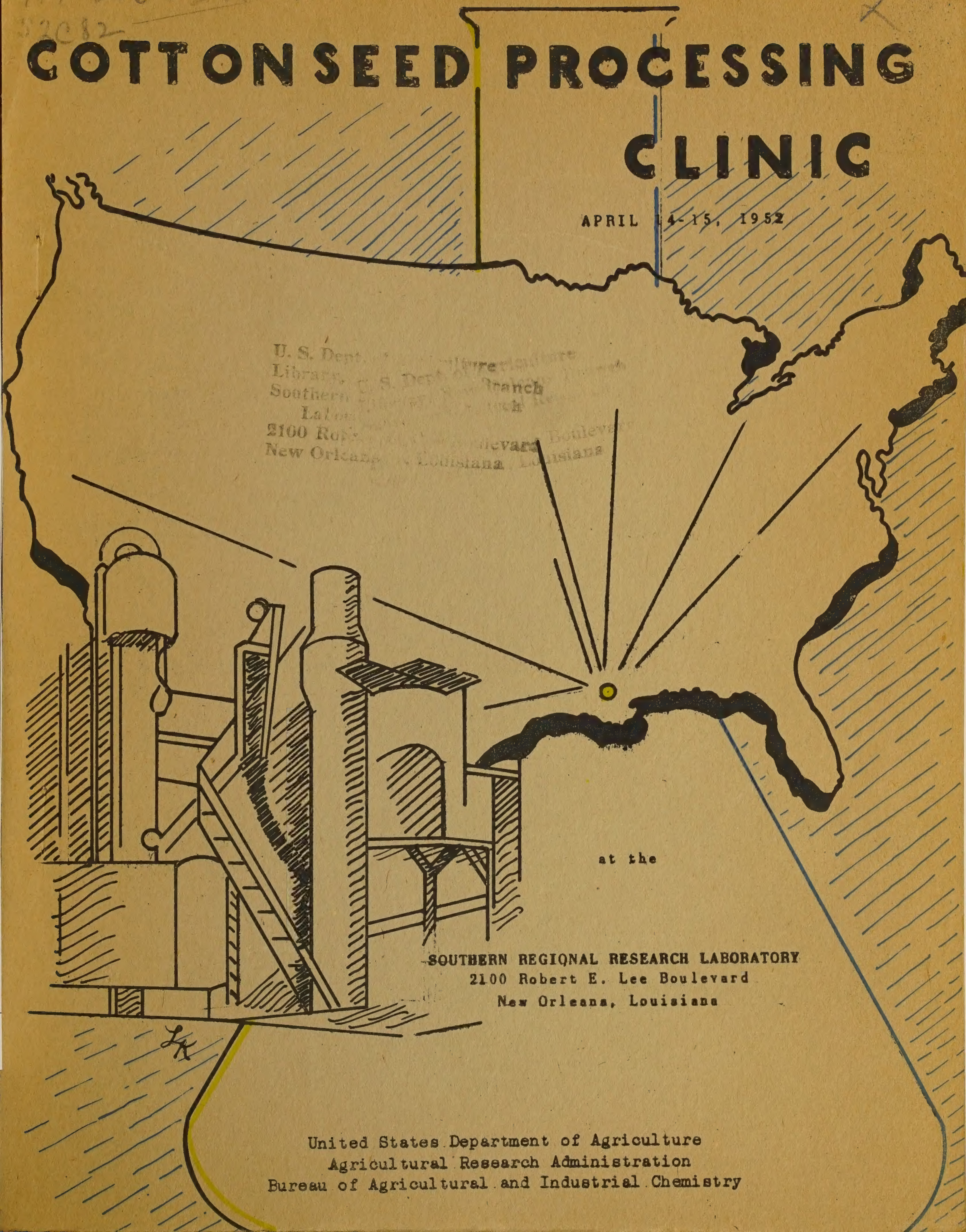
COTTONSEED PROCESSING CLINIC

APRIL 14-15, 1952



at the

SOUTHERN REGIONAL RESEARCH LABORATORY
2100 Robert E. Lee Boulevard
New Orleans, Louisiana

United States Department of Agriculture
Agricultural Research Administration
Bureau of Agricultural and Industrial Chemistry

Top: Examining a sample of cotton linters at the Cottonseed Processing Clinic held at the Southern Regional Research Laboratory in New Orleans, April 14-15, are W. B. Stone, Cairo, Ill., president of the Valley Oilseed Processors Association, and Dr. C. H. Fisher, Director of the Southern Regional Research Laboratory. Others, in front row left to right, are E. A. Gastrock, Southern Regional Research Laboratory; C. E. Garner, Memphis, Tenn., Secretary of the Valley Oilseed Processors Association. Second row, Ralph Woodruff, Osceola, Ark., vice-president of the Valley Oilseed Processors Association; Dr. E. F. Pollard, Southern Regional Research Laboratory; and T. P. Wallace, Memphis, Tenn., conference chairman.

Lower left: Discussion leaders who pointed out the "Effects of Rolling and Cooking on Milling and Extraction Efficiency and Quality of Products," at the Cottonseed Processing Clinic held at the Southern Regional Research Laboratory in New Orleans, April 14-15. Seated, left to right, W. W. Pascal, Piqua, Ohio; J. R. Mays, Jr., Memphis, Tenn.; Ralph Woodruff, Osceola, Ark.; T. P. Wallace, Memphis, Tenn. Standing, J. B. Perry, Jr., Jackson, Miss.; John W. Dunning, Cleveland, Ohio; N. Hunt Moore, Memphis, Tenn.; and J. H. Brawner, Abilene, Texas.

Lower right: Group which led the discussions on the "Effects of Mill Processing Conditions on Cellulose Yield and Quality of Linters" at the Cottonseed Processing Clinic held at Southern Regional Research Laboratory, New Orleans, on April 14-15. Seated, from left to right, are John A. Remley, Memphis, Tenn.; Dick Taylor, Arcadia, La.; Harry Craig, Cincinnati, Ohio; T. P. Wallace, Memphis, Tenn. Standing are L. N. Rogers and Allen Smith from Memphis, Tenn., and M. C. Verdery from Houston, Texas.

F O R E W O R D

The information summarized in these proceedings was presented at the Cottonseed Processing Clinic held at the Southern Regional Research Laboratory, April 14-15, 1952.

This Cottonseed Processing Clinic was a working conference held in cooperation with the Valley Oilseed Processors Association. The program for the first day was arranged and conducted by members of the Laboratory staff and for the second day by officials of the Association.

Staff members reviewed the laboratory research program on cottonseed and cottonseed products with particular emphasis on the relation and application of research results to the practical operating problems of the industrial processor. The Association speakers were particularly concerned with the delinting of the seed and preparation of the meats for extraction.

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COTTON AND COTTONSEED RESEARCH

OPENING REMARKS

By
C. H. Fisher, Director
Southern Regional Research Laboratory

Although Mr. Dawson has already welcomed you, I, too, wish to give you a warm welcome and to express the hope that you'll enjoy the Cottonseed Processing Clinic and your stay in New Orleans. I know that the Clinic will benefit us in the Southern Laboratory -- I hope that you'll profit from it, too, and that you'll want to visit us again.

While I don't want to take much of your time, I do wish to give you some general information about our Laboratory and program. This will be appropriate, I believe, because it is likely that a number of you are not familiar with the functions of the Laboratory and with several rather recent developments.

The Southern Laboratory and its three sister Laboratories -- the Northern in Peoria, Ill., the Eastern in Philadelphia, Pa., and the Western in Albany, Calif., -- were established a little more than ten years ago to investigate the processing and utilization of farm products for the purpose of developing new and expanded uses. The Southern Laboratory investigates cotton, cottonseed, peanuts, sugarcane, rice, sweetpotatoes and their products. Pine gum, citrus fruits, tung and certain vegetables are studied in six field stations associated with the Southern Laboratory. These stations are:

Naval Stores Station - Olustee, Florida
U. S. Tung Oil Laboratory - Bogalusa, Louisiana
Sugarcane Products Laboratory - Houma, Louisiana
U. S. Citrus Products Laboratory - Winter Haven, Florida
U. S. Fruit and Vegetable Products Laboratory - Weslaco, Texas
U. S. Food Fermentation Laboratory - Raleigh, North Carolina

In recent months some Divisions of the Southern Laboratory have been reorganized so that all work of similar nature is done in the same Division. This was done by replacing three Divisions,

Agricultural Chemical Research Division
Oil and Oilseed Division
Protein and Carbohydrate Division

with three others, namely,

Sugarcane Products Division
Oilseed Division
Fruit and Vegetable Division

The Station at Houma working on sugarcane products reports to the Sugarcane Products Division, the Bogalusa Station, working on tung reports to the Oilseed Division, while the three stations at Raleigh, Winter Haven, and Weslaco, report to the Fruit and Vegetable Division.

Before the reorganization, we had functional Divisions, commodity Divisions, and -- you might say -- miscellaneous Divisions. As a result of the reorganization, we now have only two types, namely, functional and commodity Divisions. The two functional Divisions are:

Analytical, Physical-Chemical and Physics Division
Engineering and Development Division

The work on oil-bearing materials and their products is now done in three Divisions:

Oilseed (A. M. Altschul)
Analytical, Physical-Chemical and Physics (T. H. Hopper)
Engineering and Development (E. A. Gastrock)

We have in the Southern Laboratory a group of excellent men, including chemists, physicists, biochemists, engineers and the like, having a knowledge of oilseeds. With the present organization of the work, I believe that these specialists will be in a better position than ever before to do research of benefit to the oilseeds industry.

It might be of interest to you that we welcome both formal and informal suggestions and advice about our research program. For example, helpful suggestions are received from our Oilseed Collaborators, E. C. Ainslie, M. L. Anson, H. S. Mitchell, and Porter Williams. Annually, these Collaborators visit the Laboratory, study our entire oilseed program and then give their comments and suggestions. Formal and official advice on oilseed work is obtained from two important Department Committees:

Cotton and Cottonseed Advisory Committee
Oilseeds and Peanut Advisory Committee

Informal suggestions are obtained from time to time from various members of the oilseed industry and industrial organizations, including the National Cottonseed Products Association, National Cotton Council, and the National Peanut Council. We invite and appreciate these suggestions. Conferences such as the present Clinic offer an excellent opportunity for the exchange of information and suggestions.

It is now accepted in a general way that research pays. To give you more specific information about how research in the Southern Laboratory and its associated field stations has paid -- and at the same time made life more comfortable and secure -- I shall describe briefly several recent developments.

Frozen, concentrated orange juice, developed jointly by the Florida Citrus Commission and our Winter Haven, Florida, Station is now the basis of an industry having an annual value of more than $130,000,000.

Acetylated cotton, a new textile material, is being commercialized. This will provide both the military and private industry with a new textile product having superior properties for some uses.

The Surgeon General and the Department of Defense have adopted the improved elastic all-cotton bandage developed in the Southern Regional Laboratory. This bandage will be made available commercially.

In a few days, it will be possible to announce a new and important product developed jointly by the Navy and our Bureau. (This product is pinic acid, made from turpentine by the Naval Stores Station at Olustee, Florida. The esters of pinic acid are excellent lubricants for turbojet engines and plasticizers for certain flexible resins used at low temperature. These products, made from domestic pine gum, can replace similar materials made from imported castor beans.)

Because of time limitations, other recent developments (cotton opener, loom attachment and improved tobacco shade cloth) put to use recently by industry or the farmer will not be described. Some developments of our oilseeds research are to be discussed in the ensuing program.

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R E S P O N S E

By
C. E. Garner, Secretary
Valley Oilseed Processors Association

Thank you, Dr. Fisher, for the warm welcome.

I can assure you, Sir, that it is genuine pleasure for all of us to be here and become better acquainted with you and your associates, as well as to have the opportunity of visiting your fine work-shop.

We appreciate, too, Dr. Fisher and Mr. Gastrock, your interest, and the interest of your staff, in setting the stage for this meeting.

Not only did the Laboratory prepare interesting and informative papers, as well as the plant demonstration outlined in the program, but also they made up and mailed out the programs, as well as other materials designed to direct attention to, and create interest in the Clinic.

Over and above this, however, on short notice they made more than 55 reservations in New Orleans hotels during Fiesta Season which is no small accomplishment.

The last time I was here without a reservation, after canvassing the situation thoroughly, I finally bedded down in a tourist court that seemed to be just slightly this side of Bay St. Louis.

It is pleasing to me, as I am sure it is to the gentlemen of the Laboratory, to see the interest in the program as evidenced by the large number of reservations.

You will better understand my personal satisfaction when you know that early in the planning we timidly inquired of Mr. Castrock if he thought the Laboratory would be justified in holding the Clinic provided we could bring 15 to 20 mill men -- there must be three or four times that many here today.

For the part played by the Valley Association in these preparations, we had the assistance of experts:

T. P. Wallace, Bob Mays, Ralph Woodruff and Allen Smith sat in on all of our conferences from the beginning, and later we had the cooperation of Mr. Rogers of the Buckeye Memphis Pulp Plant, who contributed valuable suggestions.

It was under the direction and guidance of these gentlemen that the Processors Program for tomorrow was worked out; and that is the reason it looks so good. They are here to help put it over.

All over the Belt there is much individual experimental work being done on the manufacturing problems confronting the industry, and from outside the Valley area many of those individuals have come great distances to be here today and give us the benefit of their findings.

This is wonderful teamwork and is bound to bring results.

Our thanks to M. C. Verdery for coming all the way from Houston, Texas; Dick Taylor from Waxahachie; J. H. Brawner from Abilene; Harry Craig from Cincinnati; Dr. Hickox from Knoxville; Dr. Dunning from Cleveland; Mr. Pascal from Piqua, Ohio; and Mr. Hunt Moore and John A. Remley from Memphis.

Our nearby neighbors who will contribute to the program, are Ben Perry, Jr., Grenada, Miss., and W. D. Baldwin of the Hercules Memphis Office.

Many others are attending as observers and we are glad to have them.

The interest of so large a group would indicate there may be a demand for other, similar conferences, or that this be made an annual affair; if so, we hope before conclusion of the meeting a resolution will be presented to that effect and that a Committee will be named to keep the Clinic idea alive. We can pledge cooperation of the Valley Association to help promote a continuance of these valuable conferences.

Dr. Fisher, our people, unquestionably, will get much of value from these open discussions of their mechanical problems, and we hope ideas will be developed that you may be able to embody in future research and thereby contribute to solutions of the troubles.

Again permit me to express appreciation of the interest you and your associates have taken in this meeting, and the hope it will lead to closer contact and more of the same exploratory conference. Thank you.

WHAT'S IN A COTTONSEED

By
T. H. Hopper
Southern Regional Research Laboratory

To a scientist, the chemical composition of a cottonseed is very complex; to a mill operator, cottonseed is a source of linters, hull, oil, and meal. Variations in the yield of these practical constituents is influenced by the variety and environment of growth of the cotton plant. Extremes in values found in a cooperative investigation conducted by the Southern Regional Research Laboratory and the Division of Cotton and other Fiber Crops and Diseases of the Bureau of Plant Industry, Soils, and Agricultural Engineering are given in Table 1. These ranges are for 8 varieties of cotton grown in 1947, 1948, and 1949 at 13 locations across the cotton producing regions from the east to the west coast.

Particular attention is called to the bald seed and kernel sizes expressed in grams per 100. It is suggested that pre-processing season estimation of the size of both bald seed and kernel obtained by tests on field samples may provide a guide to initial settings of the hullers and rolls, to hasten the adjustment of mill operations for the season's run. The values may be quite different from one season to another, and for early as compared to late picked cottonseed.

Cottonseed oil was found in the same investigation to vary in iodine value and composition. The relation between iodine value and percent glycerides of the fatty acids present is illustrated in Figure I. The range in iodine value for the 48 oils selected from the seed from experimental plot productions of 8 varieties, 3 years, and 13 locations was from 89 to 117. Commercial lots of oil are rarely found as low as the lower limit observed. However, such lots of high iodine value are not so rare. For oil from a given variety, the iodine value varies inversely with the temperatures existing during the period when the oil is formed in the seed.

In another investigation, conducted in cooperation with 5 commercial oil mills, some information has been obtained on the materials balance for gossypol in cottonseed processing. The approximate conditions maintained by the mills during cooking are given in Table 2. Differences are noted in the moisture contents, time and temperature of cooking the meats. These are reflected in the differences in the degree of binding gossypol during the cooking as shown by the data given in Table 3. In this table the average values for each mill are given as percentages of the amount of total gossypol in the seed processed and not as percentages of gossypol in the seed, kernel, meal, and oil. Of particular interest is the observation that screw-pressed oil contains more gossypol than the hydraulic-pressed oil. The amount of gossypol in screw-pressed oils varies inversely with the binding of the gossypol during cooking of the meats. The relation is illustrated in Figure II, in which the data for 28 individual samplings are plotted.

It is suggested that those interested in detailed information on the composition of cottonseed and its components request of the Southern Regional Research Laboratory a copy of AIC-61, "Survey of the Chemical Composition of Cotton Fibers, Cottonseed, Peanuts, and Sweetpotatoes."

Table 1. Extreme Variations in the Composition of Cottonseed (Moisture-free basis except where indicated)

		Range
Cottonseed:	Residual lint	7.2 - 18.6 %
	Hull	28.1 - 39.3 %
	Kernel	48.3 - 62.0 %
Bald Seed:	Wt. per 100	7.02 - 14.54 g
	Hull	31.8 - 44.5 %
	Kernel	55.5 - 68.2 %
Kernel:	Wt. per 100	3.92 - 9.67 g
	Oil	26.8 - 43.4 %
	Protein	30.2 - 45.9 %
	Gossypol	0.39 - 1.70 %
Hull-free meal - 12% Moisture and 3.5% oil:		
	Protein	42.2 - 58.0 %
	Gossypol	0.48 - 2.49 %

Table 2. Approximate Condition of Cooking Cottonseed Meats

Mill	Max. moisture in cooker	Cooking time	Max. cooking temp.
	%	Min.	°F.
Hydraulic Press			
A	13	90	225
B	9	68	240
Screw Press			
C	9	60	280
D	13	80	250
E	9	45	280

Table 3. Binding of Gossypol in Processing of Cottonseed. Average values for 5 mills. 1/

Mill	Bound in cooker	Bound in press	In meal as free gossypol	Removed in crude oil
	%	%	%	%
Hydraulic-pressing				
A	95.5	0.2	3.7	0.7
B	88.3	0.3	9.4	2.6
Screw-pressing				
C	60.6	23.9	3.6	12.3
D	80.6	9.2	3.0	7.2
E	77.2	9.8	3.2	9.9

1/ As percentages of the amount of total gossypol in the seed processed.

Discussion

Question: Are the data shown on the slides to be made available?

Answer: Yes. They will be included in the report of the conference. In addition, the detailed reports of the results of the investigation of the influence of variety and environment on the composition will be published in a series of journal articles.

Comment: Reference to the iodine values indicates that quite a few are lower than accepted values. These must have been from special samples which are not ordinarily encountered in commercial practice.

Answer: The oils were from experimentally produced cottonseed and not from commercial lots of seed. The iodine value of oils is not constant for a given area of production. Variety and environment influence the composition of the oil, and consequently the iodine value. It is not unreasonable that the ranges shown may occur in oils from seed produced under a wide variety of conditions, however, commercial oils being the lower values are undoubtedly unusual.

Comment: In South Texas it has been true that, according to our records, the iodine values usually never run less than 100.

Answer: That is to be expected, however, other areas where high temperatures and deficient rainfall occurs, oils with values less than 100 may be produced.

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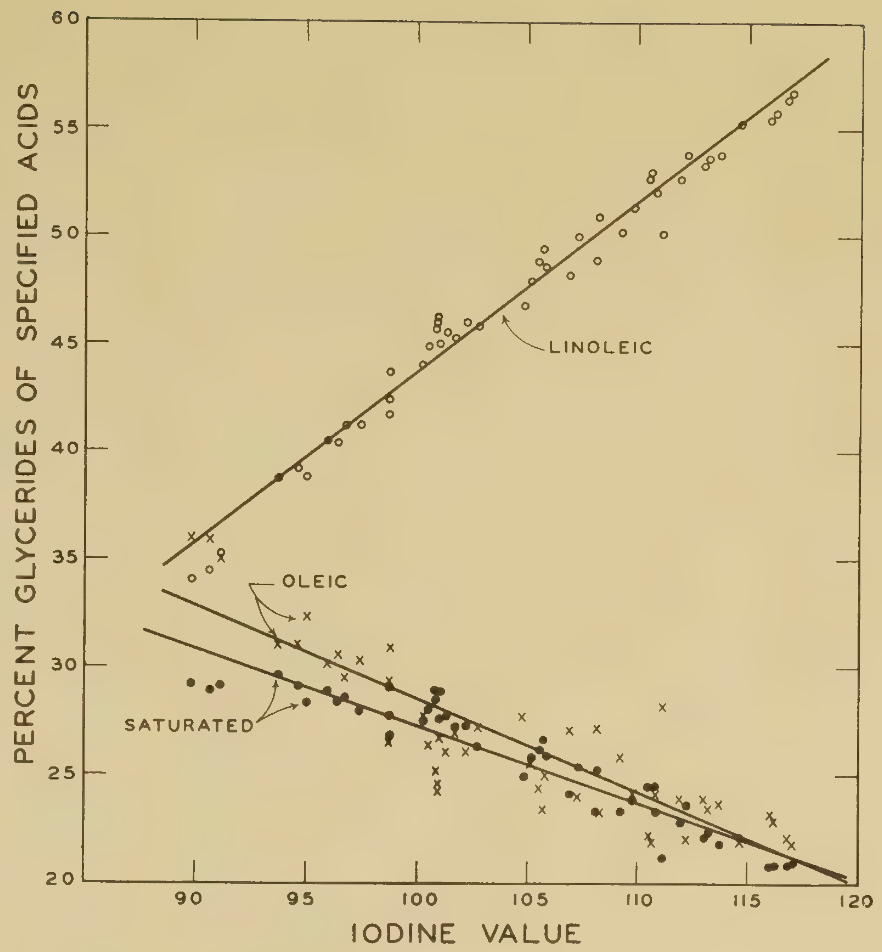

FIGURE I

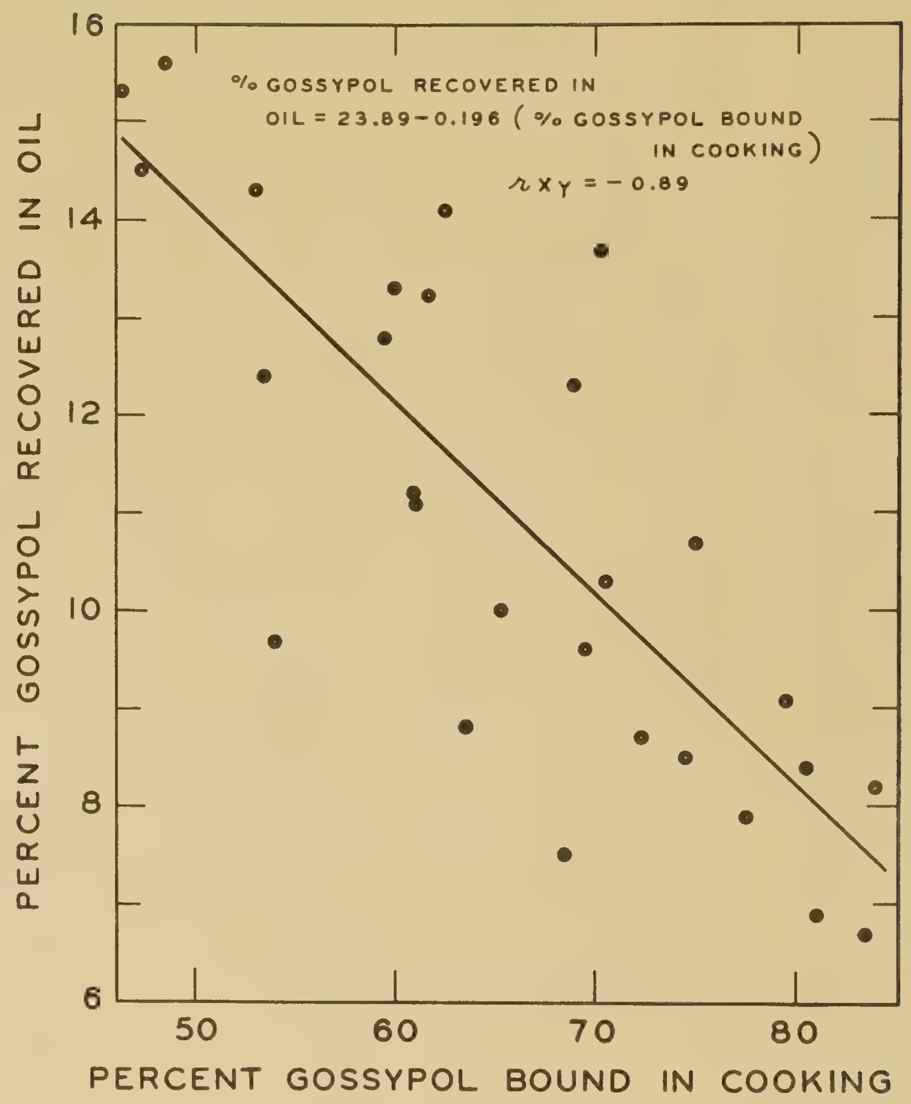

FIGURE II

NEW AND IMPROVED PRODUCTS FROM COTTONSEED OIL

By
F. G. Dollear
Southern Regional Research Laboratory

In planning the program for this Clinic, we thought that you would be interested in hearing about some of the research we are carrying out on cottonseed oil. The object of this research is to improve the quality of cottonseed oil products and to increase utilization through the development of new products.

I would like to talk first about the color of cottonseed oil and processing investigations we have carried out to improve the color of refined and bleached oil. You all know that prime seed can usually be processed satisfactorily to give a crude oil which will refine to a prime color, 7.6 red. That is, a satisfactory operation for the crude oil mill and the refiner. However, as much as 20 to 40% of the cottonseed oil from some areas may refine to give an oil darker than prime color. The refiner may be unable to produce from such oil a shortening of the almost white appearance which the American housewife has been educated to demand. Several factors may contribute to this color problem including off-grade, field damage, frosted or bollie seed; climatic conditions during growth; conditions of pressing for extraction; and length of time in storage or transit before refining. Oils refined immediately after removal from the seed are the most easily refined and bleached to light color. What happens? -- We do not as yet know the whole story on why cottonseed oils darken in storage but we are planning to investigate more extensively the pigments of cottonseed oil in relation to the color reversion problem. This will be done in close cooperation with the nutritional program in which we are trying to improve the nutritional properties of cottonseed meal.

One of the methods of processing dark colored oils is to give them a second refining or re-refining. Even this will not always give the desired color for the production of high quality shortening.

About two years ago Dr. Markley visited the Producers Cotton Oil Company in Fresno, Calif. He talked to Mr. Cavanagh who had carried out some experiments on re-refining cottonseed oil which gave lighter colored oils. He was able to aid in the interpretation of their results and they, in turn, permitted us to carry out further investigations on the process. Investigations made at this laboratory on the process of re-refining at high rates of shear, have established the optimum conditions for color reduction. In this process, the oil and alkali are stirred together at a high rate of speed, using an impeller designed to produce a high rate of shear. For most of the oils used the re-refining is best carried out by using 0.2% of 20 to 26° Baumé lye, stirring for ten minutes at 2000 to 3000 r.p.m. at 65°C. Comparisons of refined and bleached color are shown in the table.

Table I. Effect on the Color of Oils Re-Refined With Conventional and High-Shear Agitation

Series No.	Treatment of oil	Color, Lovibond units, yellow/red Oil D	Oil E	Oil F
1	Laboratory refined	70/17.9	70/14.7	70/11.3
2	Re-refined, conventional shear, 25°C., 20°Bé. NaOH, 250 r.p.m. (cup)	70/9.9	70/10.7	70/9.2
3	Re-refined, high shear, 65°C., 26°Bé. NaOH, 3,000 r.p.m.	70/4.8	70/5.8	35/4.3
4	Series 1, bleached	35/7.4	35/4.6	35/4.2
5	Series 2, bleached	35/4.1	35/3.1	35/2.7
6	Series 3, bleached	15/1.4	15/1.7	15/1.1

Some loss of oil occurs in the re-refining operation and although no greater than regular re-refining, it would be preferable to eliminate this loss. Therefore, we have investigated the primary refining operation using high rates of shear. Color reduction was not quite as effective as re-refining but the possibilities of this process have not been exhausted and research is continuing on this method.

New Products

I am going to show you a product which can be made from cottonseed oil and which has very unusual properties. It is relatively non-greasy and at the same time it is flexible. Samples have been made which could be stretched up to 800%. Flexibility is retained at icebox temperatures, that is, about 4°C. We call the product acetostearin. It can be made from hydrogenated cottonseed oil or other fats by reaction with glycerol to form monoglycerides and subsequent reaction with acetic anhydride to form the acetostearin. Work on this product was developing at about the same time we received a request for suggestions as to an edible coating which might be used for cheese. We cannot be sure as yet that this material is edible but toxocological tests are being conducted and we feel it is probable that it will be shown to be edible. Preliminary results have been encouraging. Acetostearins may be prepared with melting points ranging from room temperature to about 50°C. In addition to cheese coatings, other uses may be possible for this material such as coating of meats or frozen meats, poultry and other food products. We sent samples to a good many firms who are now making tests on this material. Another use for which this product is being tested is for the intravenous injections of fat emulsions to those who require a high caloric diet but are unable to assimilate fat through normal digestive channels. Tests also are underway to determine the action of micro-organisms on the acetostearins.

Another product that I would like to tell you a little about is a global spread. The Army does not have, at the present time, a suitable spread for bread which can be used in field rations. During the last war such a spread

was prepared but was not entirely acceptable by the men in the service because it was high-melting and gave a chewy or waxy sensation in the mouth. We are working on a global spread which contains hydrogenated cottonseed oil which is plasticized with aceto-olein, a compound similar to acetostearin, but made with the unsaturated oleic acid. Such a spread requires stability from 40°F. to 100°F. These spreads which we have prepared have incorporated in them, salt, color, and flavoring ingredients. We would like very much for you to taste this spread when you visit the laboratory.

Discussion

Comment: At present crude mills have the option of designating whether the color of refined oils from the refining loss test are to be read by the spectrophotometric or Lovibond method. Perhaps this should be revised so that the option would include color reading on oil refined by the high-shear method.

Answer: It would be difficult to do so because the refiner may not be equipped to refine by the high rate of shear method.

Comment: The refining test is a purely arbitrary test. Actually, all of the crude cottonseed oil refined is processed in centrifugals. This continuous centrifugal process is not correlated to the laboratory test method as well as the batch process. So far as the continuous centrifugal process is concerned, we have been unable to prove that high-shear method gives an improvement on refined color.

Answer: Re-refining under a high rate of shear did help in our laboratory tests.

Question: Does this high-shear method show an improvement as far as the batch method is concerned?

Answer: Yes. The value to a crude oil mill of such a processing investigation is that it will make it possible for the refiner to use oils in high grade products which are not now used because of their dark color. Thus, he will be more willing to buy these oils and this will influence the market favorably. Most continuous plants can judge what quality product they will get from the laboratory batch refining test.

Question: What were the comparative losses on refining with high shear as compared to refining and re-refining with ordinary shear?

Answer: About the same. Some oils will not respond well to high-shear refining of the crude oil. However, all dark oils could be improved in color by the high shear re-refining method. The high shear method can be applied either to batch or continuous processing. One refiner is now using a continuous method of high-shear re-refining.

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BETTER PROTEIN FEEDS FROM COTTONSEED

By
A. M. Altschul
Southern Regional Research Laboratory

The program of research at this laboratory on improving the nutritive value of cottonseed meal through improvements in conditions of processing is dedicated to the objective of broadening the utilization of cottonseed meals to be used freely in rations for growing chicks, swine, and laying hens. Attainment of such an objective would greatly strengthen the competitive position of cottonseed meal in livestock feed markets. This program is based upon two facts demonstrated by this laboratory in cooperation with the cottonseed industry and nutrition investigators.

I. The nutritive value of cottonseed meal for poultry and swine is dependent upon the conditions of processing. Meals have been produced which have the same nitrogen content, fiber content, and oil content but which have widely varying nutritive value depending upon the temperatures to which the meats were subjected during the course of processing.

II. Cottonseed meal when properly processed has high nutritive value for poultry and swine, and can be used in rations for laying hens. This was demonstrated on a special meal produced in the pilot plant of this laboratory by first extracting the oil with hexane, followed by extraction of the gossypol with butanone. This meal had not been subjected to excessive heat during processing and had low concentration of total and free gossypol in the final product. Meals of high nutritive value were also produced by the screw press process on an experimental basis in commercial mills under conditions where the meats were not heated to temperatures above 200°F. prior to being put through the barrel of the screw press.

On the basis of these two demonstrations a comprehensive cooperative program involving the Educational Service of the National Cottonseed Products Association, N.C.P.A. Fellowship, individual mills of the Association, nutrition investigators in state and federal and commercial institutions and research workers at this laboratory was initiated. The purpose was:

I. To understand the fundamental changes in oil and meal that take place in processing as they affect the quality of these materials.

II. To study the effect of different processing conditions on the nutritive value of the meal in order to determine the best possible processing conditions for producing meals of high nutritive value and unrestricted utilization.

III. To develop methods of producing meals of high nutritive value in oil mills by the various methods of processing currently used or by modifications thereof without affecting yield, throughput or quality of the oil produced along with the meal.

IV. To develop a chemical measure that will relate to the nutritive value and will not require any knowledge of the previous history of the meal. This measure would make possible better control during processing of cottonseed, could be used by the feeder to predict the usefulness of the meal and might possibly be used by feed control laboratories in order to better characterize the potentiality of cottonseed meal for various uses.

What is the present status of the development?

Meals have been produced by the screw press process which have good nutritive value. However, in producing meals at temperatures below 200° it was necessary to reduce the throughput of the press and there was a higher amount of gossypol in the oil. If the oils were refined immediately upon production, they were generally of better quality than those produced under conditions where the meats had been subjected to higher temperatures prior to passage through the barrel of the press. If, however, the oils were stored for a month or so, there was a color reversion and the oils did not have as good a color as those produced under conditions where the temperature was higher than 200°F. Therefore, in order to be able to produce meals by the screw press method which will satisfy nutrition requirements, means will have to be developed for operating screw presses at much lower temperatures. Studies of the effect of such operation on the oil will have to be undertaken so as to maintain oil quality at the same time that meal quality is being improved. It is entirely possible that the end result of such investigations will be an improvement of both oil quality and meal quality.

Some of the meals made by pre-pressing followed by extraction of the oil had low free gossypol content, and when they were produced under conditions that the temperature during the course of processing did not exceed 200°, the meals seemed to have high nutritive value. There is reason for confidence therefore that meals produced by this method can be of high nutritive value and be used in rations for poultry and swine.

The conditions required for use in rations for laying hens are much more stringent and we cannot as yet predict which meals will be suitable for that purpose.

There are now published statements in the literature by eminent nutritionists which indicate that by proper conditions of processing, cottonseed meals can be made which are the equivalent of other oilseed meals for use in poultry and swine rations. These statements should be a source of encouragement to cottonseed processors and should spur on greater efforts to improve the quality of the products of the cottonseed so as to broaden their utilization and improve their competitive status.

Discussion

Question: How long do you cook meal at 200°F.?

Answer: Approximately 20 minutes. One of the pre-pressed meals that we investigated was cooked 45 minutes at 200°F.

Question: In a stack cooker there is a 15-30 minute interval from ring to ring. If one was cooking at 230°F. would this have any effect on the meal?

Answer: Don't know what would happen in hydraulic pressing, but I hope to know at the end of the year. In screw pressing, I would say that meal would be inferior with this type of cook. As for soybeans, I don't know.

Comment: I asked a processor why they go to temperatures sometimes as high as 280°F. The gentleman answered that when something went wrong with the operation they raised the temperature and held it. Then when something else went wrong they raised the temperature again, and so on.

Comment: Well, you want to get the moisture out.

Answer: You can put on fans to take out moisture. We want to make hydraulic meal at 200°F. to see how it compares. One advantage of hydraulic pressing over screw pressing is that the hydraulic pressed meals are not subjected to the higher temperatures which occur in the screw press due to the high pressures. Therefore maybe 230°F. in the cooking stage for hydraulic might be equal to 200°F. for screw press.

Comment: You can keep the temperature down in the barrel of the screw press by running water through the barrel. As a result you can get meal outlet temperatures below meal inlet temperatures.

Comment: There are two problems in hydraulic pressing; 1) get gossypol down; 2) get gossypol down at lowest temperature. We do not have the first problem in screw pressing.

Question: What was the oil in the meal in the tests reported on?

Answer: The oil content was 3%.

Question: Did you get the same results even on varying temperatures?

Answer: Yes.

Question: Does length of time in cooker have any effect on protein value?

Answer: Much less of an effect than temperature.

Question: Was the 20 minute time cited the total time of cooking or the time the meal was held at 200°F.

Answer: The 20 minute time was the total time.

Question: Will the time that you hold the temperature at 200°F. have any effect on the meal?

Answer: Within certain limits it will not have much effect.

Comment: We have been doing laboratory work on hydraulic pressing and are still in the laboratory stage. By changing conditions we can not only prepare a product from which the oil can be extracted and which gives a meal of low free gossypol content, but also keep the temperature low enough to protect the quality of the protein. We haven't done this in commercial plants but before too long we will be asking you to do it.

Question: Does this low temperature cooking affect the oil color, refining losses, etc.?

Answer: In screw pressing when we used low temperatures for a short period of time and added moisture we did get the oil content down to 3-4%. It affected the oil in that considerable gossypol went into the oil. If you refine immediately this color danger is removed and in fact we seem to get a better quality. If you let this oil stand, considerable red color is given to the oil. We are working on this in the laboratory. The hydraulic work is still in the laboratory stage.

Comment: We have to get moisture out of the crude right away or refining losses go right up.

Answer: We know that there are lots of things in crude oil with which color can combine. If you don't get them out right away you get trouble.

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THE RELATION OF FILTRATION-EXTRACTION TO RECENT PROGRESS IN THE SOLVENT EXTRACTION OF COTTONSEED

By
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I am going to describe in this paper a new process of extracting oilseeds, called filtration-extraction, which has been developed at the Southern Regional Research Laboratory. This process apparently overcomes most of the problems inherent in conventional direct extraction and in extraction with prepressing. Besides being promising with cottonseed, the process shows promise also for application to soybeans, peanuts, rice bran, and other oilseeds. The heart of the process is a continuous horizontal vacuum filter by means of which the oil is separated after a short soaking period in a separate vessel in which the cooked flakes are contacted with the solvent.

The concept of applying the principles of filtration to the extraction of oilseeds was a direct outgrowth of previous experience at this Laboratory with solvent extraction and with the filtration of fine fractionated cottonseed meal in a hexane miscella. The earlier experiments were on a pre-pilot-plant-batch scale with raw meats that were flaked or ground in various ways. Cooked material was later tried with sufficiently promising results to warrant further development on a pilot-plant scale.

The essential difference between the filtration-extraction technique and methods practiced commercially is that in the latter the solution of the oil and the countercurrent washing with hexane takes place in the same vessel, whereas in filtration extraction the solution of the oil is accomplished in a slurry mixing tank in 15 to 20 minutes; then the concentrated miscella is separated from the meal and washed countercurrently with miscella and with hexane on the standard filtering unit, designed especially for performing such liquid-solid separations and washing under vacuum.

Equipment

Arrangements were made to borrow from a filter manufacturer a pilot-plant size continuous, horizontal, rotary vacuum filter. This unit is 3 feet in diameter, has a filtering surface of 3.5 square feet, and has all of the operating features of larger commercial units. The small filter was set up as an integral part in this Laboratory's continuous solvent-extraction pilot plant. The only modification of the standard filter required is a solvent-tight enclosure to prevent loss of solvent during its operation. Standard units having filtering areas of 10, 25, 65 square feet, or more, are available.

A solvent-tight conveyor, 12 inches in diameter by 12 feet long, is simple in construction and of nominal cost. It is equipped with paddle-type agitators and is used for mixing solvent or miscella with properly cooked and prepared cottonseed meats prior to feeding this mixture or slurry to the filter. It provides gentle agitation for 15 to 20 minutes. During this time practically all of the oil goes into solution.

Tanks, measuring devices, and pumps are provided for the various washes and the final miscella. Vacuum is supplied from a wet-type vacuum pump.

Preparation of Material

The preparation data in Table I show three main divergences from preparation for hydraulic pressing. First, the modified cooking period is shorter and cooking is carried out at somewhat lower temperatures than usually used, the maximum being about 230°F. The moisture content is somewhat higher, about 18% in the second ring. Second, it has been found desirable to cool the material before the re-forming step, which is described later. This facilitates the re-forming and is used to bring about a crisp or granular condition and to regulate the moisture content, which can be somewhat higher than the optimum value for hydraulic pressing, and much higher than the value for screw pressing. It should be apparent from this description and the flow sheet (Fig. 1) that with the filtration-extraction process the preparation and conditioning operations can be carried out in the conventional equipment used in hydraulic and screw-press mills, with only minor additions and slight modifications.

The third divergence is a rerolling of the material following crisping. This is the re-forming step. It is used to break up any small lumps formed in the cooker, to open up large hulls that have curled around meats particles, and to consolidate fines and regulate particle size.

Table I. Preparation Data

Seed quality	Prime
Flaking rolls, type	5-High
Cooking	Mod. hydraulic
Cooking time	60 minutes
Re-forming rolls, type	Single
Moisture after re-forming, %	9.6

Operation

The operation of the integrated process will be clear from a study of the flow-sheet, Fig. 1. The conditioned material is mixed with miscella (about 10% oil content) in the slurry mixing-conveyor, where, practically all of the oil going into solution, a concentrated miscella (about 30% oil content) is formed. The slurry is then deposited on the filter where the strong miscella is separated from the meal by countercurrent displacement washing, using commercial hexane. The action is too rapid to depend on leaching at this stage. During its stay on the filter the meal receives three countercurrent washes which successively reduce the residual oil content of the final meal to 1% or lower. The solvent-damp extracted meal, called the marc, is discharged from the filter by means of a motor-driven scroll.

The miscella is evaporated and stripped for oil and solvent recovery and the solvent-damp meal dried for solvent recovery in standard equipment.

Results and Discussion

The results from 3 typical runs1/ on prime cottonseed, given in Tables II - VII, present some of the operating conditions used and results obtained.

Table II shows the results obtained under the specific operating conditions listed. The feed rate was 300 lb. per hr. This rate was used because it permitted simultaneous operation of the meal dryer which has a limited capacity. (Actually, rates up to 1200 lb. per hour have been used with satisfactory extraction results.)

The solvent-to-flake ratio of 1 to 1 should theoretically provide a slightly higher oil content in final miscella than that shown, 24.5%.

However, 24.5% oil is higher than usually found in final or full miscellas in cottonseed extraction plants. The higher this value is the less steam is required for oil and solvent recovery and the greater the capacity of the evaporators used. Similarly, the value, 21.7%, for solvent in the marc is desirably low, likewise permitting steam savings and increased capacity in the marc dryers. (See Table IV for a comparison of solvent to be evaporated from 100 lb. of meal corresponding to various solvent percentages.)

1/ Articles reporting detailed data on additional runs with cottonseed and other oilseeds are in preparation.

The residual oil in the meal was below 1%, and the fines in the miscella were relatively low.

Table II. Operation of Filter

Feed rate, lb. per hour	300
Solvent to flake ratio	1 to 1
Cake thickness, inches	1
Pan speed, min. per rev.	1.5
Vacuum required, inches mercury	3.5
Oil in first filtrate, %	24.5
Fines in first filtrate, %	0.17
Solvent in marc, %	21.3
Residual lipides in meal, %	0.87

Table III gives the extraction results obtained in the three washing stages on the filter. The rapid reduction in lipides content of the cake from 12.0 to 0.9% indicates the efficiency of this operation.

Table III. Data for Material on Filter

	Lipides in Cake %	Lipides in Miscella Filtrate %
Before first wash	12.0	24.5
After first wash	1.5	11.8
After second wash	0.9	2.1
After third wash	0.9	0.6

Table IV. Percentages and Equivalent Pounds of Solvent in Marc

Per 100 pounds dry meal	
%	Lb.
50	100
25	33
20	25

The averaged data in Table V show that the quality of the oil was highly satisfactory. The data in Table VI show that meal of a satisfactory quality and a low residual oil content were obtained. The free gossypol content, the protein solubility, and the thiamin content are either as satisfactory as or better than most commercially produced cottonseed meals. The protein content for these runs is higher than the 41% protein content usually produced. The high protein value can be reduced to normal (41%) by adding hull material to the extracted meal and in so doing its lipides content and free gossypol content would be further reduced, both of which are desirable.

Table V. Oil Quality - Average of 3 Runs
Prime Seed

F. F. A., %	1.1
Refining loss, %	4.6
Color of refined oil	5.3 Red
Color of bleached oil	1.5 Red
Free gossypol, %	0.012

Table VI. Meal Quality - Average of 3 Runs
Prime Seed

Residual oil, %	0.6 - 0.9
Free gossypol, %	0.025 - 0.030
Protein, %	49.0 - 51.0
Protein solubility, %	30.0 - 38.0
Thiamin, P.P.M.	15.6
Moisture, %	5.0 - 7.0

Table VII shows actual tonnage capacities of the small filter at the specified feed rates together with the calculated capacities that should be obtainable with a 10 ft. diameter (commercial-size) filter using comparable feed rates.

Table VII. Filter Capacities*
Tons Cottonseed per 24 Hours

Feed Rate Lb./Min.	3 ft. Diam. Filter (3.5 sq. ft.)	10 ft. Diam. Filter (65.0 sq. ft.)
5	5.8	111
10	11.5	222
15	17.3	334
20	23.0	445

* Basis 1250 pounds meats-hulls mixture per ton of cottonseed.

<u>Summary</u>

The filtration-extraction process presents many advantages, summarized as follows:

Production of both oil and meal of high quality.
Lower solvent requirements, which should proportionately reduce solvent losses.
Lower solvent content of final meal and of final miscella (oil-solvent mixture), which should result in lower steam costs and smaller equipment.
Low power consumption.
Lower installed cost of plants in comparison with existing processes, making the process particularly attractive to the smaller mills.
Possibility of complete mechanization of most of the operations, and anticipation of low supervision and operating costs.
Use of conventional hydraulic or screw-pressing preparation operations without expensive modification.
Low "fines" content of final miscella.
Use of standard commercial filter units and accessories.
High production capacity per square foot of filtering area.

These advantages combine to make filtration-extraction attractive to the smaller as well as to the larger mills.

Discussion

Question: What is the temperature of the meats going into the solvent?

Answer: About 110°F.

Question: Is lowering of steam consumption the only saving, or is there also a lower investment cost?

Answer: There is a lower initial investment and a lower labor cost. Also, we do not have the power cost of screw pressing, nor the two plants to operate as in pre-pressing.

Question: For a 100 T/D plant where you would need 12 or 13 sq. ft. filter area, can you say how much it would cost to replace the conventional solvent extractor with the filter?

Answer: The 3 sq. ft. filter in our plant cost $4500. Larger filters with 10-25 sq. ft. are available commercially. The costs are greater but do not increase in direct proportion to the increase in filter area. More complete costs are due later this year. We estimate that a 100 T/D plant complete including drying and oil recovery equipment will run around $250,000. This figure is subject to a great deal of confirmation later on.

Question: You say that your unit has a capacity of 24 tons on cottonseed and 15 tons on soybeans. The capacity is not proportional to the amount of flakes fed to the machine?

Answer: Yes, it is proportional because you are feeding 100% of the weight of the soybeans to the machine and only 60% of the weight of the cottonseed.

Question: Do you have any idea about what peanuts and flaxseed will do?

Answer: We have promising results on peanuts on the pre-pilot-plant scale.*

Answer: In our small-scale work we are watching what we can do without denaturing the peanut protein. We are interested in conditions which will give undenatured peanut meal. In eight small scale runs we have achieved rapid extraction rates, residual oil below 1% and very high protein solubility; say with 90% as a basis, ours is 80%. With peanut meats rolled and cooked 25 minutes at 200°F. we get conditioning which gives the desired characteristics for filtration. We think that it will work on a larger scale.

Question: Did you compare oil quality from filtration-extraction with oil quality from hydraulic pressing?

Answer: Yes. We processed material from the same lot both by hydraulic pressing and by filtration-extraction. The oil from the filtration-extraction process was comparable both in color and refining loss to that for the hydraulic pressed oils.

Question: How can you get such low free gossypol -- 0.017 in the final meal?

Answer: By doing the best rolling job before cooking. We believe that this is so important that we will say that good cooking cannot be accomplished without good rolling. Both good rolling and good cooking are essential.

Question: What do you call thickness of rolling -- 5/1000 of an inch?

Answer: We don't have a minimum thickness.

Question: What is the effect of moisture?

Answer: The moisture content should be high enough to just avoid giving trouble on the rolls.

Question: Do you use cold water or steam for moisture conditioning ahead of rolls.

Answer: We like to see moisture in vapor phase added, but cold water will do. We use steam. Our best results are accomplished by adding as much water as possible before rolling -- up to 20% in the two top rings.

Question: Do you still maintain 200°F. before cooking?

*(Note: Flaxseed have since been run successfully on pilot-plant scale.)

Answer: Just about 200°F. We try not to get too high. Sometimes we get as high as 220-230°F. We vent.

Question: Do you want to get up to temperature fast?

Answer: Yes. We get moisture down by venting.

Question: You get moisture down to what?

Answer: We can stand 8-12%. Not as low as hydraulic or screw pressing.

Question: If you cook between 220-230°F. in a plant do you need cooling step before passing into extraction?

Answer: We cool and re-roll after cooking. We cool by evaporative cooling which reduces the moisture content slightly and gets the material ready for the second rolling. We are trying to get away from re-rolling. One of the functions of re-rolling is to break up the clumps of material formed under the hulls in cooking, which would decrease extraction of the oil. We like to get a sandy granular feel in the meal after re-rolling. This type material usually extracts readily to low residual oil.

Question: Do you re-grind after cooking?

Answer: Yes.

Question: What is the temperature of the flakes to the mixer?

Answer: About 110°F.

Question: What is the boiling point of the solvent?

Answer: About 154°F.

Question: Do you have any oil quality data on the soybean tests?

Answer: The lot of soybeans we used contained a good number of green beans, and cooking gave an increase in green color. We were able to bleach down this color, but after bleaching the oil still had a green color. We are going to try this again without cooking the beans.

Question: Do you find it necessary to cool to 110°F. before going to the mixer?

Answer: Yes. Right now we extract at about 110°F. We might get better results (raise miscella concentration, reduce residual lipids, etc.) by extracting at a higher temperature. At the same time, too high a temperature might interfere with the operation of the vacuum pump.

Question: Do you see any reason why this type of preparation wouldn't work on an ordinary extractor?

Answer: We are working here on beds of one inch to one and one-half inch thickness and get extraction and washing rates because of the thin layer. Actually, if we want to increase filtration, we increase the speed of rotation and decrease the layer thickness. You get an exponential increase in filtration time if you increase the thickness of the bed. For instance, - a one-inch bed contains so much oil. Double the thickness and you double the oil content. If the solvent ratio is maintained, you must double the solvent volume. However, you must also double the distance this wash solvent must travel, so that increased bed thickness really results in a disadvantage. With beds of one to two feet it is likely that the results would not be satisfactory. The beds of flakes in a regular basket extractor require very definite mass velocities or rates of flow of solvent and miscella through them for satisfactory operation.. I think that cooked materials have been tried in regular extractors and usually the fines problem has increased as a result of cooking.

Question: Have you run any soybeans through your screw press?

Answer: No.

Question: What is the best cooking rate to get gum out of soybeans?

Answer: Soybeans are worked on at the Northern Regional Research Laboratory. Perhaps, Mr. French or Dr. Dunning can tell you that.

Question: You say you cook to reduce gossypol by cooking up to 20% moisture in the top ring. How do you prevent formation of water balls?

Answer: It might be a good idea to answer that question and perhaps some others by some general comments. Let us start with the meats from the huller. These meats usually contain about 8% moisture.(though we have gone as high as 14%). The meats contain the pigment glands (1-2% of the seed weight) and the glands contain the gossypol (about 40%). We found that 75% of these glands are about 3 to 4 thousandths of an inch in diameter. We found also that rolling with a clearance of about 3/1000 of an inch ruptures or helps to rupture most of the glands. In order to bind gossypol or to remove it you must break the glands. The effects of rolling and cooking should be considered together. One complements the other. Moisture is important also. Raise the moisture and you break more glands. At high moisture content, and with well rolled meats, a rapid rise in temperature completes the rupture of most of the glands, brings about oil flow and binds most of the gossypol. The free gossypol is decreased to as low as 0.04% in 10-12 minutes in the first ring with moisture of 17-25% and temperatures of 190-200° F. In the second and third rings the temperature is raised to about 215° F. and the moisture reduced with vents wide open. Further gossypol reduction occurs here. Probably the most important feature in reducing moisture balls is to feed the cooker continuously. This minimizes the plastic flow of the meats in this stage of cooking and reduces formation of balls. After cooking the evaporative cooling promotes crisping which permits rapid extraction and gives a high degree of incompressibility which aids filtration. It should be noted that every step after hulling is

designed to accomplish definite results in gossypol reduction, oil and meal product quality, extraction in the slurry stage and filtration and washing on the filter. All of these steps comprise the filtration-extraction process.

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ROUND TABLE DISCUSSIONS

WHAT ARE THE EFFECTS OF MILL PROCESSING CONDITIONS ON CELLULOSE YIELD AND QUALITY OF COTTON LINTERS?

Introduction: Allen Smith

Discussion Leaders:

L. N. Rogers M. C. Verdery

Harry Craig Dick Taylor

John A. Remley

Smith

By comparison to other industries using fibers of the cotton plant, oil milling is new. Primarily, at least a part of the linters must be removed from cottonseed in processing. Market demand and price of the various grades usually determines plant production policy. In view of the probable production being in excess of consumption, it places the burden on the shoulders of the plant operators to consider yields and quality in their proper relationship.

As late as 1900, the average lint cut from a ton of seed was only 23 pounds. Today, there are many factors which influence the production of cotton linters. Now, as then, the greatest of these factors is a ready market.

Since about 1926 or '27 there has been an effort on the part of the U.S.D.A., producer, broker and manufacturer to define and establish linter grades and trading rules.

In the book "Cottonseed" edited by A. E. Bailey - Interscience Publishers 1948, you will find many informative and interesting comments on cotton linters. Chapter 12 by Mr. G. S. Meloy has to do with the "Grading of Cotton Linters." Chapter 24 by Mr. Peter Van Wyck discusses 4 main topics on "Cotton Linters." Other mention of cotton linters is found in Chapters 1-4 and 16.

Mr. W. H. Tharp in Chapter 4 gives an interesting discussion on "Cottonseed Composition-Relation to variety, maturity and environment of the plant." Time will not permit mention of the many tables, graphs and comments but here is one little table of information you may find interesting as it deals with the production of cotton linters. The table gives comparative yields of products from one ton of cottonseed in the year 1900 as compared with 1943.

	1900		1943
Crude Oil	282	-	311
Cake & Meal	713	-	887
Linters	23	-	190
Hulls	943	-	482

By addition and subtraction you will find that our pioneers in oil milling had a much higher yield efficiency than we. That is to say they lost only 39 pounds from one ton of seed. We in 1943, lost 130 pounds. However, on present market values our pioneer would receive about $72.00 for his products while we of 1943 would receive about $89.00.

Mr. Chairman I am sure there are many other sources of valuable information which are recorded and still more unrecorded. However, at present we have to deal with the subject at hand which is, namely: "What are the effects of mill processing conditions on cellulose yield and quality of cotton linters."

We are fortunate in having a panel of 5 men who are most capable in their field to discuss not briefly but fully and specifically the problems which effect our subject for discussion.

After the Speakers have presented their subjects, we hope there will be an open and full discussion from the floor.

Rogers

I have chosen to speak on the quality of linters, for to us that is the most important phase in the very near future. As far as the yield is concerned, we believe the price will take care of how much cleaning is necessary and the oil mill will probably clean no more than is necessary for the sale of their material.

The most important job which the oil mill has in the next two years is to clean the lint of foreign material; that is hulls, bran, leaves, stalks, bolls, and any other materials which find their way into linters.

It is our opinion that linters within the next two years are going to have to be at least a 73% yield, which means that the bran will have to be removed and also, it will have to be free of any of the foreign materials mentioned above. This will be necessary due to increased production and quality of wood pulp.

There have been some rayon processes in the past where wood pulp has not been used, that is, the quality of the yarn made from the wood pulp was not as good as the quality of the yarn made from cotton linters pulp. We are particularly thinking of fatigue value of tire cord yarn, where approximately 50% of all of the dissolving pulp cellulose made from cotton linters is used. Already on the market is a wood pulp made by the sulfate process which gives values almost as good as those obtained from cotton linters. We know sulfate pulp can be made with a fatigue value as high as cotton linter pulp. Therefore, we can expect in the next two or three years, as more sulphate wood pulp plants come into operation, no more linters will be sold except on a competitive basis with wood pulp.

To do this, cotton linters will be selling around 4 cents a pound if the price of wood pulp stays the same as it is at present, that is approximately $200.00 per ton. If it goes up, the price of linters will go up a little and

if it goes down, the price of linters will drop. In order for linters pulp to be competitive at this future date, it is going to have to be entirely free of these foreign materials mentioned above; therefore, it is very essential that by that time oil mills have equipment which will clean up the linters.

In our experience, we have found it very difficult to remove some foreign material from linters, so it has been our thinking that all of the foreign material should be removed from the cotton seed before the linters are cut. We think this is very important. If it is not removed, the linters will entwine around the foreign material so that air or water separation is not possible. Therefore, one of the first things, and I think a very important part of this project, is to remove these materials from cotton seed before removing the linters; we are not talking about removing 50% of the foreign materials, we are talking about removing 100%. From our experience the mills are going to have a big enough job cleaning the hull pepper and hulls from the lint which are introduced in cutting the linters, and can not expect to remove the foreign materials after cutting the linters which should be removed before cutting.

It also is a fact that linters are getting dirtier every year due to mechanical picking and more snapping; therefore, a much better cleaning job will have to be done in the future than is being done at the present time due to the fact that a lot more of these materials are to be expected in linters.

It seems to us that the number one job which oil mills should work out and have in operation within two years are cleaning systems which clean the seed 100% going into linter machines.

The second job, as we see it, is to be able to produce a cellulose yield lint of not lower than 73%. It may be that it will have to be higher than this but at the present time it looks like this will be sufficient. We think the lint, as removed from the seed, can be much lower in yield; dusting back to 73 yield does not make too much difference, as what is necessary is to have a 73% yield clean linters. The bleachers are not too much interested in how this is obtained. It is true, that if a very heavy cut is obtained, a shorter fiber will be found; and, it may be that this may have some bearing in the future but does seem to be a major problem at this time.

Above has been said a few words about the economics of linters versus wood pulp in the near future. It may be well to say a few words about why the quality has to be improved. I have a few samples here which show the type of pulp which can be obtained with good and poor linters; also, I have samples of the material which gives trouble and has to be removed. The main thing is that these foreign materials are not dissolved in digesting; they are not eliminated, but carry through with the pulp and give rayon or plastic manufacturers trouble in that it produces poor filtration or gives poor clarities or haze due to these foreign materials. These materials are not contained in wood pulp and only pure cellulose is obtained. That is the reason, from a competitive standpoint, these materials have to be removed from linters.

The question of a test for quality has been raised several times. We would suggest use of the method given in the January 1945 issue of A.O.C.S. Journal by Mr. T. L. Rettgar. We use an acetylation procedure as is shown by these samples, but this can not be used by oil mills for testing. We believe that the method of Mr. Rettgar's, for we have used it considerably in our laboratory, is a very good indication of the amount of foreign material in the linters. It does not show up some of the qualities of linters such as some of the materials which may effect haze and clarity, but there is not much the oil mills can do to these anyway, and these will have to be corrected by the bleachers. It does show, however, the large materials such as stalks, leaves, bolls, hulls, etc. and if they are eliminated, I think the oil mills will have a fighting chance in competing with wood in the dissolving pulp business.

You, no doubt, for years have been hearing that wood pulp will some day cut out cotton linter pulp. The day has just about arrived, unless the oil mills get busy and clean up their linters. Then, on a competitive basis, both price and quality, there is a very good chance that cotton linters pulp can and will be sold along with wood pulp. It has some other very definite disadvantages which the bleachers expect to eliminate. The main thing that we are asking the oil mill men to do is to take out the foreign materials and only give bleachers cotton linter fibers.

Mr. E. E. Hembree gave a talk along the same lines before the Tri-States Oil Mill Superintendents Association in Memphis on February 2, 1952. His article can be found in the March 1952 issue of the Oil Mill Gazetteer. He goes more into detail as to the affect of these foreign materials on different processes used by rayon and plastic manufacturers.

Craig

My part of the discussion is concerned with the processors' problems in producing clean linters, including the preparation of the cottonseed and the cleaning of the linters.

The production of clean cottonseed and clean linters is a never ending fight, starting with the varieties of cottonseed that are planted and ending when the linters are baled. Since we can always produce higher grade linters from clean cottonseed, the first part of our discussion will be concerned with the cleaning of cottonseed. Cottonseed is cleaned for a number of reasons in addition to the production of clean linters. Some of the reasons are:

1. Reduction of seed losses in storage.
   Nothing contributes more to the heating of cottonseed during storage and subsequent losses than the presence of foreign material. Many times the losses will be manifested only as an increased FFA content with a subsequent higher refining loss and greater discount on the oil. However, this loss is just as real as if a certain number of tons had actually been burned up.

2. Improved products quality.
   This includes first cut and second cut lint quality, hull, meal, and oil quality.

3. Reduced maintenance on mill equipment.
   Removal of certain types of foreign material is economical just to reduce the maintenance cost of saws, huller knives, grinding plates, etc.

4. Reduction of fire hazards.
   Foreign material in undelinted seed often causes fires in the linters. If we could eliminate even one minor fire by a good cleaning system it would certainly pay excellent dividends.

5. Improve general cleanliness of mill.
   The removal of dust and fine sand, fly lint, etc. make subsequent processing much easier.

Therefore, we can see a large number of reasons for doing a very effective job of cleaning in addition to the production of high quality linters.

One of the reasons that cleaning cottonseed is so difficult is due to the many types of foreign materials found in the seed. The primary types of foreign materials which we must consider when designing good cleaning equipment includes the following:

1. Sand and dirt.

2. Bolls

3. Light trash such as leaves, small pieces of boll hulls, etc.

4. Rocks

5. Metal

6. Sticks and stalks

7. Miscellaneous large material such as paper, blocks of wood, coco cola bottles, etc.

Each of you probably has an interesting list or assortment of materials which you have removed from cottonseed over a period of years. The problem is not merely just separating these materials from the seed but very often the sand and shale is embedded in the lint. Also the seed forms clumps during shipment or storage tending to trap the foreign material so that it is difficult to remove.

In removing foreign material from seed, the most acceptable equipment in use today loses valuable materials unless salvage equipment is used. Some of the salvable materials removed with the foreign material include the following:

1. Cotton fiber, or lint.

2. Grabbots.

3. Cottonseed meats

4. Small whole seed

5. Immature seed

6. Cottonseed hulls

Considering the requirements for cottonseed cleaning, anyone can define an ideal cottonseed cleaning equipment as that type of equipment which would remova a maximum amount of undesirable foreign material with a minimum loss of valuable materials. It is with this definition in mind that the types of equipment used for cleaning will be discussed. It also points out that the ideal way to obtain clean seed is to avoid the foreign material entering the seed rather than trying to get it out.

A. Effect of Seed Varieties and Growing Conditions.

The production of clean cottonseed linters starts with the variety of seed that is planted and subsequent growing conditions.

1. Certain varieties of cottonseed shatter in the linters much worse than other varieties. This increases the oil and hulls in the lint and increases subsequent cleaning problems. This is a primary difficulty experienced at our Augusta, Charlotte, Macon, Raleigh, and Atlanta mills in producing high grade linters. This is not a function of growing conditions nor seed moisture. It definitely can be traced to seed varieties. The areas planting this type of seed are expanding. Just a few years ago we had this trouble at our Augusta Mill alone. Now it has spread to cover the Piedmont Area and is moving into the Valley. We consider this one of our most serious problems since the areas are growing and we do not have any solution on how to handle this type of seed. We will discuss this further when we cover linting practices.

2. In west Texas, storm proof cotton is planted to cope with weather conditions. This cotton is much more difficult to gin without producing trashy seed. In addition, the wind in certain areas drives sand into the boll where it is difficult to remove.

3. Wet weather at certain periods in the planting or growing season will produce improperly opened bolls with immature seed. Such cotton is extremely difficult to gin and tends to be high in foreign material.

B. Effect of Field Handling

Field handling of the cotton is certainly important for producing clean linters. Hand picked cotton by tenant laborers was certainly the easiest to handle and lowest in foreign material. However, for economical reasons, mechanical harvesting is here to stay and will expand. In general,

1. Mechanical pickers do not produce as clean a product as hand picking. Perhaps equipment manufacturers could improve the design of this type of equipment to do a better job. The soybean growers have issued such a request to the manufacturers of soybean combine equipment.

2. Late season or clean up cotton is often snapped or sledded. This cotton contains a large percent of stalks and stems that are impossible to remove during ginning and produce trashy cottonseed. Improved methods for handling this type of cotton are extremely desirable.

3. Cotton fields should be kept as clean of weeds as possible especially cockleburrs.

C. Effect of Gin Operation

Gin operations in the past have been aimed primarily at the production of clean high grade cotton without worrying much about seed quality. In recent years the personnel of the USDA Cotton Ginning Laboratory at Stoneville, Mississippi have done an excellent job in developing and publicizing methods for improving seed quality in the gins. As a result of this and other similar groups, most modern gins are equipped to do a good job of seed cleaning in addition to the production of high quality cotton. The modern gins are also equipped with dryers that make it possible to handle wet seed much more effectively and produce good products. However, there are further improvements possible especially in the older gins. In general, gin operation could be summarized as follows:

1. The operators of the new modern gins must make certain that their equipment is in a good state of repair and operated most efficiently for producing good quality products. Even the best equipment can be operated poorly and produce poor products.

2. Many of the older gins are not equipped with separate seed and trash conveyors. This means that the trash is dropped into the same conveyors with the seed and a trashy seed sent to the mills.

3. Dumping the seed rolls from the gin into the finished cottonseed is a bad practice that is fairly common. This not only increases the foreign material but provides a bed of trash that serves as a nucleus for heating during storage.

4. Dump seed rolls often on trashy seed.

5. Clean seed houses.

D. Cleaning Before Storage

Because of the large quantities of seed received at a mill during the unloading period, it is impractical to attempt a thorough cleaning before storage. This does not mean that we should not make every effort to do partial cleaning at this point. However, the removal of part of the sand from seed is about the only type of foreign material that can be removed from a practical standpoint. The removal of sand will increase the efficiency of air cooling equipment and tend to retard the heating of seed in storage. The removal of sand before storage can be done by means of perforated conveyor bottoms in unloading conveyors. This does not require a long length of perforated conveyor bottoms for removal of a large part of the sand. Generally, a 10-20 ft. section of conveyor locked at the discharge end is ample. The bottom of this conveyor should be closed with 3/32" round perforated metal. It may be necessary to install a short section of conveyor to handle the sand under the main seed conveyor or at some mills a closed sloping chute could be used to confine the sand to a central point. In no case should the sand be allowed to build up to the bottom of the seed conveyor.

E. Cleaning Room Operation

The types of equipment used in mill cleaning rooms vary considerably. The following types of cottonseed cleaning equipment are used in a large number of mills.

1. Boll and sand reels.

2. Bauer pneumatic, #199, and #201 cleaners.

3. Rock shakers and air traps for separating rocks.

4. Electro and permanent magnets.

In order to get the maximum efficiency of any cleaning room the load to the cleaning equipment must be regulated with a feeder hopper or day bins. The feed from such a bin or hopper should be variable; otherwise, a common occurrence is to find the cleaning equipment operating at a heavy load or at no load for several hours each day. We will discuss the major pieces of equipment and methods for improving the operation for maximum efficiency.

1. The sand and boll reels.

The boll reels should remove cotton bolls and large pieces of foreign material such as blocks of wood, paper, or anything larger than the size of a cottonseed. The sand reels should remove sand and other fine foreign material. This equipment will do a very effective job if carefully cleaned and maintained. Very often the equipment is enclosed and not inspected at frequent intervals to make certain the screens are not torn or plugged. Cleaned, well maintained sand and boll reels will do a very effective job in cleaning cottonseed. We have equipped most of our reels with brushes to keep them clean.

2. Bauer Pneumatic, #199 and #201 cleaners.

The Bauer pneumatic cleaners have been used in mills for a long period of time. These units removed small pieces of foreign material, generally smaller than 1/8", and were equipped with a vacuum chamber to separate rocks, small pieces of material, black seed, and light trash. The Bauer #201 cleaner was originally designed for crushing peanuts and was adapted in some cases to operation on cottonseed. However, the features of the pneumatic and #201 cleaners have been incorporated in the Bauer #199 cottonseed cleaner and some extra features added. The Bauer #199 is probably the most common cottonseed cleaning unit in use today. This single unit has the following purposes:

a. Removal of material by a permanent magnet between feeder and upper shaker.

b. Removal of bolls, grabbots, and large foreign material on upper shaker.

c. Removal of sand, black seed, meats, and small foreign material on lower shaker.

d. Removal of sand from above mixture in discharge spout from lower shaker.

e. Removal of black seed and rocks in vacuum chamber.

f. Removal of light trash from vacuum chamber.

This unit is quite effective in cleaning cottonseed without any other auxiliary equipment. The operation on wet seed is not as good as desired but no cleaning equipment known will operate under such circumstances. The main restriction on successful operation of this cleaner is to avoid overloading. The units are used both in parallel and in series. Capacity of 75 tons per day per unit is common. However, very often the capacity must be reduced to 30-50 tons per day to do an effective job on dirty seed.

3. Rock Shakers

The rock shaker serves to separate linty seed and large rock from small rocks and black seed. The linty seed can be aspirated at the end of the shaker deck from the large rocks with the rocks routed to discard. The mixture of small rocks and black seed passed through the metal on the shaker must be separated by flotation or some other method to obtain benefit from this equipment. Air traps are often used as a substitute for rock shakers and considered equally effective and lower in cost. The Bauer cleaners are equipped with traps that make this equipment unnecessary.

4. Electro and Permanent Magnets

Magnets will remove some metal from seed. The effectiveness is proportional to the cleaning frequency and the method of installation. Permanent magnets are preferred since they have low maintenance and do not require a generator. They also cannot be turned off. The main point concerned with magnet installation is to locate them so that cleaning can be easily accomplished. Be sure that the layer of seed is run over magnets.

F. Cleaning in First Cut Linters

Cleaning can be improved at the first cut linters by increasing the moting. This produces poorer quality motes but improves the seed quality to the second cut linters.

G. Cleaning Between First and Second Cut Linters

Cleaning the seed between the first and second cut linters is very effective.
Removing the first cut lint makes the seed easier to handle and easier to clean.
Carver seed separators, perforate conveyors, and Bauer #199 cleaners have been used for this purpose. The cost of equipment is relatively high and space requirement is often a limiting factor.

H. Cleaning in Second Cut Linters

A large number of adjustments can be made in the second cut linter to improve lint quality. Brushless attachments on the linter, especially when combined with slotted elbows, help a great deal.

A primary problem of cleaning in the linters is due to hulling of the seed in the linters. We carefully conducted a material balance over our Augusta Mill while operating on the variety of seed that shatters readily. During this test an average of 200# per ton of motes (up to 300#/ton) were removed from the second cut linters. This material was primarily hull fragments and cottonseed meats that were formed in passing through the linters. This is an extremely serious problem and we have no answer to it.

Operation of a mill on more than two lint cuts emphasizes the problem of hulling in the linters very seriously. Any time this type of seed is handled back through the linters an extra time the extent of the hulling increases greatly. This is more than enough to nullify any advantages normally obtained from multiple lint cuts.

This hulling in the linters is serious for several reasons:

1. Lint loss is increased since the lint cannot be removed from the shattered hulls.

2. The oil loss and oil in lint are increased greatly. This is a definite loss of oil in addition to degrading the linters.

3. Subsequent lint cleaning problems are magnified due to the presence of additional foreign material, mainly hulls.

4. Salvage of the meats from the motes is extremely difficult and requires additional work.

Cleaning Linters

1. Use of beaters

Carver and Fort Worth lint beaters do a very effective job in removing the foreign material from lint. The main trouble with beaters is that we always tend to overload them. Any mill crushing 125-150 tons of cottonseed per day should have at least two beaters. Installation in series is better than in parallel. This can be justified from an economical point of view to up grade lint quality.

Reclamation of Discards

1. Boll reel discard

Mitchell separators do an excellent job for reclaiming grabbots. Brust boll and grabbot pickers have been used and do a fair job of separating bolls from grabbots in seed. The grabbots are often sacked and sold as such for reprocessing at a cotton gin. This equipment is only fair and improvement is desired.

2. Sand reel discard

The meats in this material can be salvaged in a small sand shaker. The lint should be aspirated from the end of the upper deck and routed to the motes beater. The second deck should be clothed with the proper size metal to retain the seed, meats, and hulls, and permit the sand to pass through. The sand should be discarded and the meats sent to the huller.

3. Rock separators

Bauer Bros. #210 stoner or Sutton Steele and Steele specific gravity separators do a very effective job for removing the stones from the salvable material in seed.

Future Work

Improvements are desired in the cleaning of cottonseed at the following points:

1. Learning how to handle seed that hull in the linters.

2. Improved methods for removing sticks.

3. Improved cleaning of wet seed.

4. Improved, cleaning methods for seed high in trash and bolls.

SUMMARY

In summation, we have tried to point out that cleaning of cottonseed is not confined to the cleaning room by any means. It must be started with the varieties of the seed planted, go through field handling, mill handling, and a good cleaning room, and end up in the linter room. The production of clean cottonseed and clean linters must be considered at each point cottonseed are handled. If we do this, we will be able to supply the highest quality cottonseed linters that can be produced.

Discussion

Question: What was your disposal of the flue bran?

Answer: We sent it to our basket extractor. This method will result in a loss of oil if we use presses.

Question: How much flue bran was there per ton?

Answer: Approximately 30 pounds per ton.

Question: Would you comment on the use of flue bran in your plant?

Answer: We are putting it directly into the meat stream. Sometimes we think that we are losing money on it.

Question: What variety of seed gives you so much bran?

Answer: Coker type seed of the southeast.

Question: How much rise is there in the gossypol content of the meal due to adding flue bran to the extracted meal stream?

Answer: Up from 0.02 to 0.04 percent.

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Verdery

Multiple Linting is not a new idea, having been practiced to varying degrees by Southland and other oil mill groups for several years, but during the past two years there have been further developments and improvements in procedure, certainly more experience gained, and I am now convinced that it is an essential for maximum efficiency in the Lint Room.

There are two distinct phases to multiple linting. The first phase, and the one in general use, is the proper arrangement of conveyors and elevators

to make the desired number of passes of seed through the linters. By making three, four, or even five passes, rather than the conventional two cuts, we obtain the following principal advantages:

1. More uniform linting with considerably less effort and supervision. For example, it is seldom if ever necessary to adjust the breast on fourth cut linters as all of the seed will be consistently uniformly delinted and there will be practically no "wild" seed. In attempting to delint to less than 2% left on seed with the conventional two cuts the Linterman must constantly check and adjust the breast to do a uniform job of linting.

2. Slightly higher average production of lint per linter. On a four-cut installation the production of second cut will be much higher than normal, the third cut will be in line with average production and the fourth cut less than average with the average overall production running slightly higher than normal. On practically all of our multiple cut installations they are operating with looser rolls which naturally results in less hulling of seed in the breast.

3. Any Linterman knows that a linter is a good seed cleaner and it is obvious that the multiple cut idea with corresponding additional opportunities to "mote out" trash will result in improved lint quality.

The second phase, and in my opinion equally important, is the arrangement of proper lint flue systems and lint beaters to handle and process the lint from the respective multiple cuts. Some of these advantages are as follows:

1. Much greater flexibility, even where only 2 cuts are being baled. For example, with a four-cut installation the first cut would be baled as usual and the second, third, and fourth cuts blended and baled together. If it should be desirable and profitable to produce a heavy first cut or light mill run, it would be a simple matter to blend first cut and second cut and then a blend of the third and fourth cut would constitute the chemical lint production.

2. Flexibility in marketing. With the conventional arrangement of first and second cut lint we have little choice of procedure except to vary the ratio between the first and second cut yields. With multiple cuts it is possible and in some cases has been very profitable, to produce a light first cut, a light second cut and then blend third and fourth cut for the chemical trade. An alternate combination which is more applicable to today's market would be to bale first cut as usual, produce an extra high grade quality second cut by blending second cut and third cut and then bale the fourth cut separately. This fourth cut would, of course, be a very short fiber, slightly darker in color and perhaps comparable with hull fiber and, naturally, would bring a lower price than top quality second cut, but in many cases the above combination would result in an overall higher products revenue.

From our experience during the past 2 years I would say that 4 cuts is the most practical arrangement from a standpoint of flexibility and for uniform delinting, however, a three-cut installation would certainly be a big advantage over the conventional two-cut arrangement and, of course, in many old installations would frequently be much easier and less expensive to install.

I do not feel that the five-cut arrangement has enough advantages over the 4 cuts to justify its cost but in some cases the design and arrangement of the lint room might make it advantageous. For example, on one of our large mill installations with 60 linters they happen to be arranged in 5 groups of 12 linters each and the design called for the installation of 5 separate lint flue systems. It was also felt that 5 lint beaters were indicated and in this particular case we felt that 5 separate cuts were justified.

I am frequently asked the question "how many linters would you put on each cut, or what distribution would you make between the various multiple cuts?" Frankly, I do not think it makes a great deal of difference. Naturally, you would install the required number of first cut linters to make the desired yield of first cut lint and if you were making a four-cut installation, you could divide the balance of the linters between the remaining 3 cuts. On practically all of our new four-cut installations we have made an equal division between the 4 cuts and arranged the linters in 4 equal groups. This generally works out more satisfactorily from a standpoint of conveying and elevating and lint flue systems, but in existing installations where the linters and the lint flue systems are not equally divided, I think that deviations from the above would not make any difference. For example, in a mill with 24 linters, I would normally install 6 on each cut, but I think it would be just as well to have 8 second cuts, 6 third cuts and 4 fourth cuts, however, I would not recommend handling more than 25 tons of seed per day through any one linter.

On a conventional installation making 2 cuts of lint it is common practice and good design to install an overflow bin after the first cut and second cut linters. For the sake of simplicity and economy, with the multiple cuts we have installed overflow bins after the second cuts and fourth cuts. This allows a slight overflow from the first cut linters to pass on to the second cuts but it does prevent any undelinted seed going on to the third cuts or any partially delinted seed going to the hullers and I would say that this arrangement is satisfactory.

On a multiple cut installation the relatively light second cut will not work too satisfactorily on linters equipped with brushless attachments as this operation is similar to the first cut linters which are never used with the brushless device. Therefore, we recommend using brush linters on first cut and second cut and brushless devices on third cut and fourth cut.

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Taylor

Increasing amounts of machine picked cotton has led to an increase in the amount of trash in the cotton as received at the gins. Proper cleaning starts at the gin and must include the disposal of removed trash rather than adding it back to the seed.

The best piece of cleaning equipment in an oil mill is the first cut linter machine. Further cleaning should be done between each cut where multiple cuts are used. In my opinion 4 cuts are much superior to the conventional two-cut operation.

Our cleaning problem is complicated by the sterilization necessary to combat the pink boll-worm. Steaming prior to cleaning imbeds the dirt so that it is much more difficult to remove.

Under present conditions the price differential up or down from the base price does not justify expensive cleaning. However, cleaning may improve the market for the expanded sale of linters.

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Remley

I have come this morning as a representative of the paper industry, not to tell you anything about production of linters but to learn from your papers and discussion. This is a relatively new raw material for us, and we are extremely glad to learn more about it.

The paper industry's principal fibers are wood and cotton. The wood pulp portion of the industry has been increasing rapidly while the portion of the industry employing cotton as a raw material has been relatively static because of the limited supply of cotton rags which is its traditional raw material. The rags used are new cotton clippings, threads, etc., and not the old worn rags collected by the junk dealer which largely go into roofing papers. The introduction of synthetics, such as nylon, rayon, etc., has caused these cotton clippings to be more and more objectionable, forcing the paper manufacturer to look elsewhere for cotton fiber.

The paper mills have used raw staple cotton in the bale but the present prices make this uneconomical. The industry has grown cotton on an experimental basis in West Texas where a short but satisfactory fiber can be produced at a relatively economical figure. The data secured indicates that cotton can be economically grown for paper making. Even if it were grown today, it would be more profitable for the mills to sell the cotton or put it in a government loan than to put it in their own paper.

Of the several fibers other than wood pulp that have been investigated, cotton linters show the greatest promise. Cotton linter pulp has for some years been secured from the bleachers and used in certain grades of paper.

Surplus mattresses largely made from cotton linters were dumped on the market after the end of World War II and satisfactorily used in paper making. The paper industry is now exploring the possibility of extending the use of raw linters purchased on the open market.

Most of the paper mills have been processing linters on existing equipment that was originally installed to handle other cotton fibers, usually cotton rags. The mills have been reluctant to introduce any special cotton linter handling equipment because of the possibility of another cotton acreage reduction. It has also been difficult for them to purchase a uniform clean linter because of the lack of a method of grading and testing that is recognized as standard in both industries. The U.S.D.A. method of specifying government grade is helpful but is not sufficiently precise. The cellulose yield determination is also helpful but does not tell us anything about fiber lint and strength. I wish to emphasize that while all of the criticism that I have heard this morning directed by the bleachers is in harmony with our criticism, we do not dissolve the linter. The paper mills cook and bleach and attempt to retain as much of the original fiber strength as possible. We have the same objection to shale, cockleburs, and other similar foreign material as Mr. Rogers and Mr. Craig.

With length of fiber and amount of foreign material important in our process, it would be most important to us as buyers, and I would think to the cotton oilseed industry as sellers, to have an industry-wide standard for measuring the essential characteristics of cotton linters. If a cotton linter producer could tell us the length of the fiber together with the amount of foreign material present and perhaps kind of foreign material together with any other characteristics considered essential, the movement of cotton linters to paper mills would naturally be expedited.

I want to thank you for the privilege of attending your meeting this morning and say that I am much encouraged by the interest in producing cleaner and better cotton linters.

Discussion

Question: What is the potential market in the paper industry represented by cotton linters?

Answer: It is very difficult to answer because it will depend on the availability of other fibers which are interchangeable with linters. One way to guess at the quantity is to take the annual production of the mills producing cotton content paper which is about 150,000 tons. We might consider that half of this is cotton fiber. From a purely experimental basis we have increased the use of linters until over one-fifth of the cotton fiber has become linters. In the absence of governmental crop restrictions, or unusual war demands, or anything that might cause linters to be very high in price and low in quality as they were a year ago, it is entirely possible that the percentage would increase until it is a major part of the cotton fiber used by the paper mills.

While the individual paper mills have many and varied problems in introducing the linters into their papers, the greatest stimulus for them to use more linters would be an abundance of satisfactory linters at a reasonable price.

Question: Do you want a better grade of linters than that now going to the paper industry?

Answer: Clean first cut linters are excellent. The grade is satisfactory if the cleaning is sufficient. Certain papers require longer staple (first cut) but many others can use short length fibers.

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WHAT ARE THE EFFECTS OF ROLLING AND COOKING ON MILLING AND EXTRACTION EFFICIENCY AND QUALITY OF PRODUCTS?

Introduction: J. R. Mays, Jr.

Discussion Leaders

G. H. Hickox — M. W. Pascal

J. W. Dunning — Ralph Woodruff

Mays

This discussion will cover the preparation of cottonseed meats for the extraction of oil by various methods, viz. hydraulic pressing, expeller or screw pressing, direct solvent, prepressing and solvent, and filtration-extraction solvent. It will begin with the rolling or flaking of the meats and continue through the cooking process. While maximum yields of oil are considered of primary importance, the quality of the oil, and of the meal produced by each of these methods, have an important bearing on the subject.

The literature contains a number of references on the rolling and cooking of cottonseed meats for hydraulic pressing. The published information on expeller and screw pressing operations is more limited. Reports on the various methods of solvent extraction seem to have emphasized the extractor more than the preparation of meats.

As hydraulic presses still predominate in the industry, gains in oil extraction by any other process are usually referred to this older method for comparative purposes. Likewise, oil quality must meet or exceed the standards of the trading rules which were developed around this type of oil.

During the past few years, investigations of meal quality have been greatly accelerated. Studies of meal produced by the newer processes were brought about by necessity, and this has given impetus to an over-all investigation which will include every type of meal. Here we find a condition unlike that pertaining to oil. Hydraulic meal may not be considered a standard.

It so happens that more work has been undertaken on the other types of meal, with improvement in their quality. With the same attention directed to hydraulic meal, equally good results may be expected.

While the demand for cottonseed meal this past year has been such as to minimize the importance of meal quality, the time will undoubtedly come when this matter will assume considerable importance. Meantime, research is being carried on which will bring a solution to this problem.

Hickox

The University of Tennessee is now conducting experiments to determine the effect of a number of processing variables on the hydraulic extraction of cottonseed oil. This work is being done for the Department of Agriculture, through the Southern Regional Research Laboratory. The purpose of the study is to determine whether the yield of oil can be increased using present hydraulic pressing equipment and to determine the effect, if any, caused by such increased yield on the nutritive values of the meal and the quality of the oil.

With regard to the effect of cooking, which has been the subject of some discussion this afternoon, cottonseed has been cooked at temperatures ranging from 200° to 250° and no effect on the amount of residual oil has been observed. Similarly, cooking has been carried on for different lengths of time, ranging from 30 minutes to 120 minutes and there was no effect on the amount of residual oil. No information is yet available as to the effect on oil quality or nutritive value of the meal. In speaking of the cooking time it is well to define terms. We have found in our work that it takes at least 20 minutes to raise the temperature of the meats from room temperature to 220 degrees, so that when we speak of cooking for 30 minutes, a total time of 30 minutes is meant and not 30 minutes at 220 degrees temperature.

Most of our effort has been spent on determining the relationship between pressing moisture, pressing temperature, and the residual oil; and we find that these three variables are intimately related. If residual oil is plotted on a chart on which the pressing moisture is the vertical ordinate and the pressing temperature the horizontal ordinate, we find that there is one combination of moisture and temperature that gives the least residual oil for a given set of pressing conditions. For the pressing arrangement adopted, this point is at about 7 percent moisture on a dry, oil-free basis and 215 degrees pressing temperature. For other combinations, the residual oil is greater. In actual mill operations, the average temperature of the cake is about 185 degrees and the residual oil cannot be reduced below about 6 percent on a dry, oil-free basis, even at the best moisture content. Also, if the temperature is increased at that moisture content, the residual oil is not decreased accordingly. The decrease in residual oil can be accomplished only by decreasing the pressing moisture as the pressing temperature is increased. This subject is a little bit complicated and we hope to present it more fully by publishing the results of our studies.

The pressing scheme adopted was to raise the pressure on the cake to 2000 pounds per square inch in four minutes and to hold it for a total pressing time

of 30 minutes. The rate of application of pressure was found to be important. In one set of tests the pressure was raised to 2500 pounds per square inch in four minutes instead of 2000 pounds per square inch. At the end of 30 minutes there was more oil left in the cake than there was for 2000 pounds per square inch. The reason for this was not found until we made tests in which the pressure was applied very slowly, being raised to 2000 pounds per square inch in 16 minutes. In this case we got a reduction in the residual oil. The pressure was then raised to 2500 pounds per square inch in 5 minutes, the same rate at which it was raised to 2000 pounds per square inch and there was a reduction in the residual oil. This indicates that the rate of application of pressure is quite important and that the pressure should be applied slowly.

Some statements have been made to the effect that the oil yield can be increased by mixing hulls with the meats. Our tests show that this is not the case. The greatest oil yield occurred with the lowest hull content, and this was for mixtures ranging from 29 to 54 percent hulls.

The results with regard to moisture, pressing temperature, and residual oil have been verified by tests made in a commercial oil mill. The general relationship was very similar to that found in the laboratory and while the actual quantity of residual oil was not the same, being about 1 percent greater than for the laboratory tests, the mill tests indicated that increasing the pressing temperature and reducing the moisture content would result in about the same degree of increased oil yield as the laboratory tests under the same conditions. For this reason, we believe that our tests, which have been made on a very small scale indeed, are reasonably satisfactory and can be applied to actual oil mill conditions.

All our tests to date have been directed toward reducing the amount of residual oil in the meal. We are now performing additional tests to determine the quality of the oil and the nutritive value of the cake in the regions where the residual oil is the least. When this has been accomplished we expect to report the results in a form which it is hoped will be useful to oil mill operators.

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Dunning

The rolling and cooking operations of cottonseed milling are a very small part of the many operations involved in cottonseed milling. The rolling and cooking of the seed, however, play a very important part in this milling operation. The rolling of the meats reduces the meats to a thinness which permits the subsequent cooking operation to be effective.

The cooking operation, as you all know, frees the oil from the oil cells for ready extraction; precipitates or solidifies the proteins; deactivates the enzymes which cause free fatty acid rise and so on. In addition to these classical reasons for cooking there are 5 other reasons that are of paramount

importance: Proper cooking makes it possible to increase the capacity of oil expressing equipment; it reduces the maintenance cost of this equipment; it reduces the power consumption; cooking improves oil quality and cooking improves meal quality.

In our discussions on rolling and cooking we define rolling as that operation of passing cottonseed meats through a 5-high, 60" roller mill at a rate of 125 to 150 tons of cottonseed per day to give rolled meats of approximately .010" thickness. We define cooking as the process of maintaining the rolled meats at 185 to 205°F. for a period of time ranging from 10 to 20 minutes at a minimum moisture content of 12%. The shorter time of cooking is employed in the prepressing phase of the Exsolex Process. The longer time of cooking is employed in single pressing.

Data are presented in Table 1 which summarize the effect of rolling and cooking on capacity, power consumption and quality of oil from different Expeller mills. All data are averaged from two to four weeks operation in each mill.

Table 1. - Cottonseed Mill Data

	Mill No.			
	1	2	3	4
Rolling of Meats	Yes	Yes	Yes	No
Cooking Time, Minutes	15	0	0	0
Cooking Temp., °F.	185-205	---	---	---
Moisture of Meats, %	12	10.6	11.4	13.0
Res. Oil in Cake	3.5	4.2	5.0	4.9
F.F.A. in Seed	0.6	0.4	0.5	0.5
F.F.A. in Oil	0.8	1.2	1.2	1.4
Refining Loss:				
Regular Method	6.3	12.5	10.9	13.1
Expeller Method		7.5	6.6	8.0
Refined Red Color	4.6	4.3	5.5	4.5
Bleach Red	1.1	2.1	1.3	2.4
Expeller Motor Loads				
Vertical Shaft, %	69	94	70	70
Horizontal Shaft, %	55	50	48	47
Capacity - Tons Seed/Day	25	25	22	21.3

It will be observed from Table 1 that Mill No. 1, which rolled and cooked according to the above definition, had a very low free fatty acid rise during the oil expressing process. Each of the other mills, which did not cook properly, experienced an appreciably higher free fatty acid rise, the greatest rise occurring in the mill wherein the meats were not rolled. It is of importance also to note the refining loss of the oils produced in different mills when refined by the regular methods. It is observed from Table 1 that the refining losses by the regular method in Mills No. 2, 3, and 4 are much higher than in Mill No. 1 where proper cooking was employed.

The work on rolling and cooking of cottonseed has been carried to the extent that it has been possible to double the capacity of an Expeller and yet not increase the residual oil in the cake any appreciable amount. Data averaged from one months operation of a cottonseed mill which was processing the meats from 200 tons of cottonseed through 4 Super Duo Expellers is summarized in Tables 2 and 3. The mill employed two 5-high stack cookers for the cooking of the rolled meats. The conditions maintained in the stack cooker are summarized in Table 2.

Table 2. - Conditions Existing in 5-High Stack Cooker

Ring No.	Temp. °F.	Moisture %	Free Gossypol %	Time Minutes
1	165	12.1	0.62	19.5
2	208	11.2	0.20	13.7
3	217	8.4	0.08	13.7
4	222	6.1	0.06	13.7
5	238	4.2	0.06	11.7

Each Expeller was processing in twenty-four (24) hours the meats from 50 tons of cottonseed. This operation over a months period furnished oil and meal that analyzed as shown in Table 3.

Table 3. - Oil and Meal Quality Data

Meal:	
Residual Oil, %	3.8 to 4.3
Gossypol, %	0.016 to 0.03
Protein Solubility, %	12.0 to 17.0
Oil:	
F.F.A., %	0.64
Refining Loss: (Regular Method)	5.64
Refined Red Color	5.24
Bleach Red	1.5

From the above mill data it is apparent that cooking, according to the above definition, results in a greatly increased Expeller capacity. This cooking procedure also makes possible the production of an improved meal and an oil that refines by the regular hydraulic method to values similar to hydraulic oil. The cooking procedures also permits a reduction of the horsepower required to process a ton of meats.

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Pascal

In this meeting and similar meetings devoted to the processing of cottonseed, many talks are devoted to the importance of adequate cooking to achieve optimum results when using hydraulic or mechanical presses. Two speakers have already gone into detail, with exact figures of the method of cooking employed on the quantity and quality of oil produced, as a result of the cooking method used. Yet nowhere do I find any reference to two very important functions performed by the cooking, nor any accounting for the fact that the exact data placed before you by these gentlemen, can not be transferred, "in toto" to your mill with similar results.

While it is appreciated that this meeting is devoted to the practical application of mill operation, it should not be remiss to inject a little theory or hypothesis. The functions of cooking referred to earlier are protein denaturation and the change in the oil system from the absorbed to the adsorbed state. These changes take place because the undenatured protein molecule is very large and has a greater affinity for water than for oil. In the application of heat, in the presence of moisture, the water vapor is driven into the protein molecule, condensing it in size and at the same time displacing the oil contained within the protein molecule. This action frees the oil and permits ready extraction under pressure. (Most of you have encountered this phenomena when extracting high oil content seed, such as peanuts, when free oil floats out of the cooker doors.) The degree that this function is performed in the cooking operation determines the amount of oil remaining in the cake after pressing. Further denaturation takes place during pressing and after the protein is "set;" no further oil can be removed by the application of pressure. Setting of the protein can be likened to the setting of concrete.

My present work takes me into many mills. In checking results of the mills using our equipment, we find that they are in the main, very consistent. Periodically, however, we find the results, for short periods, will vary from the norm considerably. When questioned, the stock reply of all superintendents is the same -- the seed changed. As we all know, he is absolutely correct. However, with a knowledge of protein constituent variation and its effect upon the cooking, he could more readily correct the situation than with his present means.

In the literature you will find that all seeds contain four types of protein, classified as to their solubility in water, alcohol, alkali and acid. They are albumine, globuline, gluteline and prolamines. You will also find that the proportion of these proteins will vary with the different kind of seed and that variations will occur within the same kind of seed depending on the vagaries of nature during the growing season and the soil and climate where the seed was grown. Inasmuch as all but the prolamines can be affected by the cooking, depending on the acidity of the system during the cooking, it is readily discernible that a variation in the constituent protein of the seed will cause a considerable variation in the cooking requirement of the seed.

Another point worthy of consideration regarding the protein constituents of the seed being processed, is in relation to the refining loss of the oil produced. It is a well known fact that the free fatty acid content of the oil is not a true measure of the refining loss but will vary considerably in oils with identical free fatty acid content. This variation can be accounted for by the amount of soluble proteins contained in the oil, since they act as surface active agents and will retain in suspension greater quantity of solid matter the greater the quantity of soluble protein contained in the oil. Since all proteins are coagulated by heat, the importance of cooking in relation to the variation in protein constituency can be readily understood; it affects not only the quantity of oil produced but the quality as well.

While it is true that these remarks are my own theory to account for the variations encountered in cottonseed crushing, they are not entirely without fact but based upon work in connection with development of technical proteins and a study of vegetable seeds directed toward their development. Thank you.

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Woodruff

First a word about Flaking. A brief description of a part of our plant might be helpful. We have a 100 ton meat surge bin between our separating room and our preparation room.

Our preparation equipment setup is as follows: A steamer, which consists of a water tight conveyor with steam jets and hot water nozzles; and a heater, which is a revolving steam tube heater and two stack cookers. Either or both of these may be used.

I should say at the outset that one of the most important factors in our operation is a uniform flow of raw material into and through the plant. We cannot do any sort of work if we are running at one rate one hour and another rate another hour. Obviously, proper balance cannot be maintained with a fluctuating flow of material into the plant. An erratic operation for as short as a thirty minute period will affect the extraction results of a complete eight hour shift. The maintenance of a level flow of material, solvent water and steam is most important. Efficient operation requires a proper balance at all times between the material flow and all other factors. Proper moisture control in flake preparation is essential to optimum extraction efficiency. Proper control of moisture must be maintained if proper flaking is accomplished. By this, we mean that at our own plant we must get as nearly to 9.00% flake moisture at the flakers as is possible. In the case of high moisture seed, this means reduction of moisture in the heater just ahead of the flakers. In the case of dry seed, this means the introduction of steam and in some cases hot water in the steamer just ahead of the heater.

Briefly, insofar as flaking for straight extraction is concerned, we have found that when we get a flake ten-thousandths of an inch in thickness and one that will hold together, we cannot improve upon this flake, insofar

as flake structure is concerned. Too dry meats will not flake but will shatter and form fines, which, of course, give us trouble in the extraction plant. Too wet meats are doughey and will not form a good flake. Of course, rolls must be properly maintained and roll surfaces must be kept in good order.

Proper flaking cannot be accomplished on rolls or flakers that are pitted or worn. We use three heavy duty 20" by 42" flour mill type flaking mills.

I would also like to say a word about the importance of the removal of lint fibers from the meat stream prior to entry to the preparation room. These have no place in a solvent extraction plant and gave us some trouble in the early operation of our plant. This problem was reduced by use of aspiration at every point where access to the meat stream was available between the hullers and flakers.

In an effort to contribute something to this discussion that might be of some value and also for the purpose of seeking help in solving one of the most difficult problems we have faced in straight solvent extraction, I would like to present two or three examples of work at our plant with some comment as to our own evaluation of results; then I should like to ask a few questions. We have proved to our own satisfaction that cottonseed meats with F.F.A. content of not more than 1.5% and with a moisture content under 16% may be extracted to a residual oil content of 1% to 1.50% consistently, with proper preparation prior to extraction. By proper preparation, we mean heating the cottonseed meats from 165°F. to 175°F. and adjusting the moisture content in meats to approximately 9.00% or as near 9.00% as possible. The meats are tempered or heated just prior to flaking; the temperature is brought up rapidly. In the type heater we are using, which is a revolving cylindrical steam tube heater (a converted grain dryer), we have a retention time of 8 to 10 minutes. On prime seed we encountered no difficulty and have no oil color problem and are able to handle cottonseed of a fairly high moisture content if the F.F.A. is low.

Our problem has been the inability to cook or temper high F.F.A. cottonseed prior to extraction without damaging the oil from a standpoint of color. We have tried flaking and cooking, cooking cracked meats, and then flaking with no appreciable difference in oil quality values and with a slightly higher residual oil in the cracked cooked flaked meats. The following examples are typical of many test runs on our cooking equipment in 5 years of straight solvent extraction. The results of all the tests have been very similar. These cooking trials were made on two 5 high 72" French Cookers equipped with extension rings and sitting side by side in our plant.

For Run No. 1 the meats were prepared by flaking to 0.010" and cooking for 50 minutes. Cold water and steam were added in the top ring of the cooker. The cooked flakes were discharged from the cooker at 170°F. For Run No. 2 meats from the same lot of seed were prepared in the same manner, except that the cooked flakes were discharged from the cooker at 225°F. For Run No. 3 meats from another lot of seed were cracked and cooked for 55 minutes. Cold water only was added to the top ring. The cooked cracked meats were discharged

from the cooker at 220°F. in a very oily and well broken condition. They were cooled to 140°F. and flaked to 0.010". For Runs 4 and 5 the meats were flaked to 0.009 to 0.010" and given no pre-cooking or pre-tempering. Flaking under 0.008" results in a loss of structure and creates more fines.

Table 1. - Seed, Oil, and Meal Quality

	Run 1	Run 2	Run 3	Run 4	Run 5
Seed					
Moisture, %	12.4	12.4	13.5		
Oil, %	19.2	19.2	19.2		
Ammonia, %	3.74	3.74	3.6		
FFA, %	5.5	5.5	2.8		
Oil					
FFA, %	4.7	4.9	3.0	2.9	2.9
Loss, %	16.1	11.9	8.2	8.3	8.6
Color	12.6	15.2	11.5	5.5	5.3
Meal					
Moisture, %	8.8	9.0	9.1	7.32	8.5
Oil, %	2.5	2.4	3.1	3.0	3.16
Ammonia, %	8.3	8.5	8.33	8.23	8.42

We have, therefore, found it necessary to reduce our tempering or cooking prior to extraction as the F.F.A. content in the oil in the seed rose. We have just finished running a few days on cottonseed averaging 7.00% FFA and 14.00% Moisture and produced six tank cars of crude with an average of 7.5 Red refined color and an average bleach of 1.8. The average refining loss on the six tank cars of crude was 23.6%,the average F.F.A. content of the crude was 7.6,and the average residual in the finished meal was 3.9%. In order to produce oil of this color, it was necessary that we use no heat ahead of the extractor. We could have reduced this residual figure by heating or cooking prior to extracting but we would have produced a crude oil that would have been so high in color that the Chemist would have been unable to read it.

1. The question uppermost in our minds has been and still is whether off quality cottonseed may be extracted to a low residual figure without endangering the quality of the crude with reference to color?

2. Has this difficulty been overcome by prepressing?

3. How does this work compare with work on cottonseed comparable in quality when processed through an expeller plant or through a hydraulic plant?

RESOLUTIONS

The following motions were proposed and carried unanimously:

"To extend thanks to Dr. Fisher and the staff of the SRRL for this splendid conference and the many courtesies given to members of the Valley Oilseed Processors Association attending the conference."

"To hold another such meeting in 1953."

The following committee was appointed to make plans and arrangements for the 1953 meeting: T. P. Wallace; J. R. Mays, Jr.; J. B. Perry, Jr.; M. C. Verdery; E. A. Gastrock; Ralph J. Woodruff; C. E. Garner; Allen Smith; Harry Craig, and L. N. Rogers.

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APPENDIX

PROGRAM

April 14, 1952 - 10:00 a.m. Chairman, P. R. Dawson, SRRL
Conference Room - SRRL

Opening Remarks - G. H. Fisher, Director, SRRL
C. E. Garner, Secretary, VOPA

What's in a Cottonseed?
T. H. Hopper, Head, Analytical and Physical Division, SRRL

New and Improved Products from Cottonseed Oil
F. G. Dollear, Oilseed Division, SRRL

Better Protein Feeds from Cottonseed
A. M. Altschul, Head, Oilseed Division, SRRL

Luncheon - 12:30 p.m. - Beach House

April 14, 1952 - 2:00 p.m. Demonstration of Filtration-Extraction Process
Pilot Plant, SRRL

3:00 p.m. Chairman, P. R. Dawson, SRRL

Conference Room - SRRL

The Relationship of Filtration-Extraction to Recent Progress in the Solvent Extraction of Cottonseed
E. A. Gastrock, Head, Engineering & Development Division, SRRL

General Discussion

April 15, 1952 - 9:30 a.m. Chairman, T. P. Wallace, Carver Cotton Gin Co.
Conference Room, SRRL

What are the Effects of Mill Processing Conditions on Cellulose Yield and Quality of Linters?
Allen Smith, Perkins Oil Company

Discussion Leaders: T. P. Wallace, Carver Cotton Gin Company
L. N. Rogers, Buckeye Cotton Oil Company
Harry Craig, Proctor and Gamble Company
M. C. Verdery, Anderson-Clayton and Company
Dick Taylor, Southland Cotton Oil Company
John A. Remley, Texas Fiber Institute

Open discussion from the floor.

Luncheon - 12:30 p.m. - Yacht Club

April 15, 1952 - 2:00 p.m. Chairman, T. P. Wallace, Carver Cotton Gin Co.
Conference Room, SRRL

What are the Effects of Rolling and Cooking on Milling and Extraction Efficiency and Quality of Products?
J. R. Mays, Jr., Barrow-Agee Laboratories, Inc.

Discussion Leaders: J. B. Perry, Jr., Grenada Oil Mill
G. H. Hickox, Engineering Experiment Station, University of Tennessee
Dick Taylor, Southland Cotton Oil Company
Dr. John W. Dunning, V. D. Anderson Company
W. W. Pascal, French Oil Mill Machinery Company
Ralph Woodruff, Osceola Products Company
J. H. Brawner, Western Cottonoil Co., Abilene, Texas
N. Hunt Moore, Memphis, Tenn.

Open discussion from the floor.

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LIST OF ATTENDANCE

Industry

Barton, R. C., Forrest City Cotton Oil Co., Forrest City, Akr.
Bates, W. F., Rose City Cotton Oil Mill, Little Rock, Ark.
Blomquist, Carl W., Port Gibson Oil Works, Port Gibson, Miss.
Brawner, J. H., Western Cottonoil Co., Abilene, Texas
Bremer, J. W., Swift & Co., Chicago, Ill.
Brewster, John M., Agr. Econ., U.S.D.A., Washington, D. C.
Burrow, M. Gerald, Planters Oil Mill, Tunica, Miss.
Caldwell, C. H., Perkins Cotton Oil Co., Memphis, Tenn.
Chisolm, Buff, Trenton Cotton Oil, Trenton, Tenn.
Christian, C. G., Desoto Oil Co., Memphis, Tenn.
Covington, G. E., Magnolia Cotton Oil Co., Magnolia, Miss.
Craig, Harry, Buckeye Cotton Oil Co., Cincinnati, Ohio
Crockin, J. M., Lukens Steel Co., Coatesville, Pa.
Dunklin, George, Planters Cotton Oil Mill, Pine Bluff, Ark.
Dunning, J. W., V. D. Anderson Co., Cleveland, Ohio
Durham, Warren A., National Blow Pipe Co., New Orleans, Louisiana
Eubanks, E. H., Swift & Co. Oil Mill, Cairo, Ill.
Evans, Earl, Nashville Cotton Oil Mill, Nashville, Tenn.
French, A. W., French Oil Mill Machy. Co., Piqua, Ohio
Gandy, Dalton E., National Cottonseed Products Association, Ruston, La.
Garner, C. E., Valley Oilseed Processors Assn., Inc., Memphis, Tenn.
Gilbert, R. A., Arcadia Cotton Oil Co., Arcadia, La.
Gillentine, Ottis, Tupelo Oil & Gin Co., Tupelo, Miss.
Glayton, L. C., Cottonseed Oil Mill, Port Gibson, Miss.
Greer, Tyree, Trenton Cotton Oil Co., Trenton, Tenn.
Harris, Hal, Miss. Cottonseed Products Co., Greenwood, Miss.
Hasen, C. W., Chickasaw Oil Mill, Memphis, Tenn.
Hayne, W. P., Independent Mill & Gin, Alexandria, La.
Hodges, Lawrence H., Forrest City Cotton Oil Mill, Armour & Co., Forrest City, Ark.
Holley, A. P., V. D. Anderson Co., Memphis, Tenn.
Huneycutt, J. Ralph, Planters Cotton Oil Mill, Pine Bluff, Ark.
Jones, E. V., Amory Cotton Oil Co., Amory, Miss.
Katzenmier, C. Y., Port Gibson Oil Works, Port Gibson, Miss.
Knost, M. F., Gulf Refining Company, New Orleans, La.
Kressenberg, E. E., Chickasaw Oil Mill, Memphis, Tenn.
Kurtz, A. E., Lukens Steel Co., Coatesville, Pa.
Lampert, C. E., Gulf Refining Co., New Orleans, La.
Letchworth, M. P., Leland Oil Works, Leland, Miss.
McCloran, R. L., Memphis Cotton Oil Mill, Memphis, Tenn.
McGuire, Philip J., Oliver United Filters, Oakland, Calif.
Mays, J. R., Jr., Barrow-Agee Laboratories, Memphis, Tenn.
Moore, N. Hunt, 1206 Sledge Ave., Memphis, Tenn.
Newby, Wales, Cotton Products Co., Opelousas, La.

Industry (Continued)

Pascal, W. W., French Oil Mill Mach. Co., Piqua, Ohio
Patterson, Robert, Trenton Cotton Oil Co., Trenton, Tenn.
Perry, J. B., Jr., Miss. Cottonseed Products Co., Jackson, Miss.
Remley, John A., Texas Fiber Institute, Memphis, Tenn.
Roberts, L. E., DeSoto Oil Co., Memphis, Tenn.
Rogers, J. A., Miss. Cottonseed Crushers Assn., Jackson, Miss.
Rogers, L. N., Buckeye Cotton Oil Co., Memphis, Tenn.
Sandahl, Craig W., Southern Cotton Oil Co., Greenville, Miss.
Shaifer, S. B., Leland Oil Works, Leland, Miss.
Sims, E. C., Amory Cotton Oil Co., Amory, Miss.
Sims, Redding, National Blow Pipe Co., New Orleans, La.
Smith, Allen, Perkins Oil Co., Memphis, Tenn.
Stone, W. B., Swift & Co., Cairo, Ill.
Taylor, Dick, Southland Cotton Oil Co., Waxahachie, Texas
Taylor, G. C., Arcadia Cotton Oil Co., Arcadia, La.
Verdery, M. C., Anderson, Clayton & Co., Houston, Texas
Wallace, T. P., Carver Cotton Gin Co., Memphis, Tenn.
White, C. E., Planters Oil Mill, Tunica, Miss.
Wiley, A. L., Perkins Oil Co., Memphis, Tenn.
Wilson, F. E., Texarkana Cotton Oil Corp., Texarkana, Ark.
Woodruff, Ralph, Osceola Products Co., Osceola, Ark.
Woodson, P. Frank, Woodson-Tenent Labs., Memphis, Tenn.

State Universities and Experiment Stations

Hickox, G. H., Engineering Experiment Station, University of Tennessee, Knoxville, Tenn.

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SUMMARY

(Note: This summary of the conference was furnished on April 24, 1952 to trade and technical journals serving the oilseed industry.)

New ideas and old problems in the cottonseed processing industry were aired April 14-15 at the Southern Regional Research Laboratory in New Orleans when industrial representatives from nine states met with the Laboratory's research workers.

This working conference, held in cooperation with the Valley Processors Association, Inc., was opened jointly by C. H. Fisher, Director of the Laboratory, and C. E. Garner, Secretary of the Association.

Attendance and interest at the meeting were so gratifying that recommendations were made to hold another clinic next year. Plans and arrangements will be drawn up by the following committee: T. P. Wallace; J. R. Mays, Jr.; J. B. Perry, Jr.; M. C. Verdery; E. A. Gastrock; Ralph J. Woodruff; C. E. Garner; Allen Smith; Harry Craig, and L. N. Rogers.

Association representatives described their operating problems, and staff members from the Laboratory reviewed most of its research program on cottonseed and cottonseed products. The filtration-extraction process recently developed at the Southern Laboratory was demonstrated and there was an opportunity for the conferees to tour the building and inspect research facilities.

P. R. Dawson of the Southern Regional Research Laboratory presided on Monday when staff members T. H. Hopper, F. G. Dollear, A. M. Altschul, and E. A. Gastrock presented talks on cottonseed, cottonseed oil and meal, and the relationship of filtration-extraction to recent progress in the solvent extraction of cottonseed.

T. P. Wallace, of the Carver Cotton Gin Co., Memphis, Tenn., presided on Tuesday when Allen Smith of the Perkins Oil Co., Memphis, Tenn., and J. R. Mays, Jr., of the Barrow-Agee Laboratories, Inc., Memphis, Tenn., analyzed two important subjects for subsequent discussion by panel leaders. These subjects were: "What are the Effects of Mill Processing Conditions on Cellulose Yield and Quality of Fibers?" and "What Are the Effects of Rolling and Cooking on Milling and Extraction Efficiency and Quality of Products?"

Discussions on the "Effect of Mill Processing Conditions on Cellulose Yield and Quality of Linters" were led by L. N. Rogers, Buckeye Cotton Oil Co., Memphis, Tenn.; M. C. Verdery, Anderson-Clayton and Co., Houston, Texas; Dick Taylor, Southland Cotton Oil Co., Waxahachie, Texas; Harry Craig, Buckeye Cotton Oil Co., Cincinnati, Ohio; T. P. Wallace of the Carver Cotton Gin Co.; and John A. Remley, Texas Fiber Institute, Memphis, Tenn.

Discussions on the "Effects of Rolling and Cooking on Milling and Extraction Efficiency and Quality of Products" were led by Ralph Woodruff, Osceola Products Co., Osceola, Ark.; J. W. Dunning, V. D. Anderson Co., Cleveland, Ohio; Dick Taylor, Southland Cotton Oil Co., Paris, Texas; J. B. Perry, Jr., Grenada Oil Mill, Grenada, Miss.; G. H. Hickox, Engineering Experiment Station, University of Tenn., Knoxville, Tenn.; W. W. Pascal, French Oil Mill Mach. Co., Piqua, Ohio; J. H. Brawner, Western Cottonoil Co., Abilene, Texas; and N. H. Moore, 1206 Sledge Ave., Memphis, Tenn.